AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION

VOLUME 24 NEW YORK AND LONDON NUMBER 38

Published at 218 William St., New York,
Every Thursday by the

American Machinist Press.

[INCORPORATED.]

Also published at 34 Norfolk St., Strand, London, W. C.,
Every Saturday.

Correspondence on mechanical subjects solicited. Name and address must always be given—not necessarily for publication.

Address all business communications to the American Machinist Press. Matter for reading columns may be addressed to the Editor.

Subscribers can have address changed at will. Give old and new addresses. Date on wrapper denotes end of month in which subscription expires.

Subscription Price:

$4 per year, postage prepaid, to any post office in the world. No back numbers beyond current year.
For sale by newsdealers, generally.

Subscription agent for Denmark, Norway and Sweden, V. Lowener, Copenhagen. Subscription agent for Germany, Austria and Holland, Gustav Diechmann & Sohn, Neue Promenade 4, Berlin. Subscription agent for Spain, J. F. Villalta, Puertaferrisa, 7-9 Barcelona.

Entered at New York P. O. as mail matter of the second class.

Cable address, "MACHINIST," N. Y.
Lieber's and A B C Codes.

The Death of the President.

This issue of the "American Machinist" is published in America on the day set apart for the last act in the sad tragedy begun at Buffalo and which has deprived the country of its constitutionally elected chief executive. Nothing has been developed which tends to show that any cause, good or bad, has gained anything whatever by the murderer's act. Even the crazy ideas which he is supposed to represent are no nearer realization than before. We still live under a constitutional and strong government, formed and perpetuated by the people and one which they have the authority and the right to change in any manner or to any extent that may seem best to them. This they may do peacefully and in the manner prescribed by the Constitution—a fact which removes the last shadow of an excuse for the assassination of our President or of any public officer. Particularly does this apply to one who, though some of his public acts and policies aroused strong opposition from citizens as patriotic and as devoted to the public welfare as himself, yet seemed always chiefly concerned to interpret and so far as possible to execute the popular will, even though this sometimes directed him to a course opposed to his own previously declared beliefs and principles. President McKinley's attractive personality and blameless private life endeared him to his countrymen, and in a long public career no act of his has ever been attributed to a sinister motive, even by his political opponents.

It is probable that the niche in the temple of fame to be occupied by McKinley will be the higher for the address delivered by him the day before he was shot and which we commented upon last week. His words on that occasion plainly showed that he clearly recognized that the conditions under which our international trade must hereafter be carried on had materially changed and that we must change our methods to meet them. This address was such as no hidebound or narrow-minded stickler for consistency could ever have uttered. Its terse, epigrammatic sentences are likely to be much quoted in the future and they have already made a very favorable impression abroad in quarters where such favorable impressions needed, and still need, to be made in order to remove serious and threatening obstacles to the development of our foreign trade.

There are a few dreamers or fools who think that we can live without law, and if one of these will give his life for it he can some time take the life of the law's most exalted representative. It could not be expected that such as these should discriminate. Lincoln and McKinley, in their minds, are in the same category with Nero and Caligula. It is pitiful that all human safeguards should fail to foil such as these. When one succeeds in his murder it can be looked upon not incorrectly as a most deplorable but a not altogether preventable accident. The fabric of State is not jostled by it. The functions of government, the industrial and commercial activities are disturbed by scarcely a ripple and flow on as smoothly and as strongly as ever. The death of the President gives us the profoundest assurance of the unity of our people, and tells the alarmist and pessimistic onlookers of the nations that none is more stable than ours. The event so deplorable finds us at peace with all the world and with all our industries in fullest swing; if these conditions do not continue it will be through the operation of other causes than the death of any man, however exalted or however charged with responsibilities of state.

Is Skilled Labor of any Use?

It is of course the universal rule that they who know nothing about a given thing are ever ready to say that it is of no use anyhow. The ignorant ruffian cares nothing for art, and the ditch digger thinks we would be as well off if there were no such things as astronomical observatories or astronomers. By generations of experience, however, and by observation of the difference in results obtained by novices or inexperienced men when compared with the work of thoroughly trained and skilled men, people generally have come to know that training and skill count for something in nearly all industrial operations, and it is therefore the more surprising to observe that one of our contemporaries which would have us believe that it knows something of handicrafts is engaged apparently in an attempt to show that regularly trained men are useless and that to do almost any kind of work in a machine shop or rolling mill it is only necessary to take a laborer and give him a chance to learn and in a few weeks he will be as good as the best. First we were told about a planer hand that was made out of a laborer in almost no time at all, and then we learned of a sheet steel roller that was made out of a school teacher in about the same time. It is useless to argue these matters. One who knows so little of the value of manipulative skill or of the time that is required for any but exceptional men to acquire it could not be convinced of it by any amount of argument, nor, on the other hand, will his opinion have any weight with those who know by experience or have intelligently studied the advantages to its possessor and his employer of a thorough training. Perhaps we should be thought discourteous if we were to say that we could take almost any intelligent man that had never seen an editor's den and in a week train him to write a better editorial article on skilled labor than those our contemporary has perpetrated; but it is our honest conviction that we could do it.

The South African Outlook.

Regarding trade in South Africa, Consul General J. G. Stowe writes from Cape Town in part as follows: "British trade is envious of the vast strides made during the last four years in the exportation of manufactures and products of the United States, particularly to British colonies and dependencies. It is suggested that 'a coalition of the British manufacturers interested particularly in the mining, engineering and allied trades, should be formed without delay, to obtain sites in Johannesburg, where stocks may be kept for the

prompt delivery of goods.' This is to forestall possible similar action on the part of American manufacturers, to secure the Transvaal mining trade. While the resumption of mining operations may portend much, I believe that there will be no immediate demand for mining machinery and appliances, for the reason that large orders have been placed (many in the United States), and at the coast ports much machinery, etc., can be found waiting for a clear track to the Transvaal. Recently, ten Baldwin and ten Schenectady engines have arrived, and have completed the 1,000-mile run required by the specification. Many objections to them have been made, particularly by the operators—objections too ridiculous to mention—but the engines are busy. . . . Mr. C. B. Elliott, general manager of the railways of Cape Colony, is now on his way to the Continent and the United States. In a recent interview he stated in substance, referring to purchases for the railways, that 'a preference would be given to English manufacturers, with a certain margin.' But he added that the Cape government was cosmopolitan, and if the Americans offered an article as good as that offered by England, at a price below the margin referred to, the order would be given to them. Some time ago an order for 167 'steel self-dumping coal cars' was sent to an American manufacturer. These have arrived and are being erected at Cape Town and Port Elizabeth. . . . Great stress is laid upon the published statistics of Cape Colony and Natal, which show a decrease in 1900 (compared with 1899) of United States imports, amounting to £334,507 ($1,627,878.32), while the increase of imports from the United Kingdom for the same period was £1,372,258 ($6,678,093.56). A decrease is also shown in the imports from almost every other country. The United States lost 12.6 per cent., Germany 23.7 per cent., Belgium 11.2 per cent., and Austria 54.6 per cent. I contend, figures to the contrary, that 1900 has been the largest export year of the United States to South Africa. The statistics of 1900 cannot be depended upon, as there is an entire absence of returns from Delagoa Bay. . . . As to the future, it is said that plans are matured for expending $50,000,000 in new railways; that several thousand miles of telegraph lines are to be erected and renewed; that $5,000,000 is to be spent for public works, and $15,000,000 on harbors; that $500,000 is to be invested in electric lines in Natal; and twenty-five or more millions are to be expended in the Transvaal and a proportionate amount in the Orange River Colony. We must not fail to bid for this work. . . . Allow me to suggest to the hundreds who do not care to visit South Africa and must therefore send catalogs, not to print prices in the same, for the printed prices are not, merchants state, high enough to cover, in all cases, expenses connected with the receipt and selling of the goods. Naming net prices would be better, and then a distinction must be made between the regular dealer and the wholesaler, for the latter must be protected."

American Locomotives on the Continent.

Concerning American locomotives in Europe, Dean B. Mason, vice and deputy consul-general, writes as follows from Berlin: "Up to the present, in spite of the large and continued importation of American machinery, the American locomotive, which has for many years been largely and successfully used in Russia, can hardlly be said to have made more than an appearance in Germany. The Bavarian State Railway authorities have during the past two years ordered and used a small number of American locomotives for experimental purposes, and the Prussian Government is also operating a couple of our engines. . . . It has been ascertained, however, through reliable private sources that the results obtained in Bavaria have been highly satisfactory, and have dissipated the belief which has hitherto prevailed in official circles that American engines were not adapted for use on German railroads. It is therefore considered extremely probable that the American type of engine will be built by the German locomotive builders within a short time. The Prussian railroad authorities are at present experimenting with the so-called superheated steam engines made by Schmidt, in Cassel. Should these tests not prove satisfactory, it is thought likely that the American type of locomotive will be adopted in Prussia. . . . Since 1893, the year of the Chicago exposition, no important fact of American railway development has escaped the attention of German railway managers. Expert commissions and individual engineers have gone to the United States and spent months in studying every detail of construction and management. The vestibule express train and the sleeping and dining car have been copied almost literally. More recently the enormous freight trains of 40-ton cars drawn by powerful locomotives worked up to their full capacity, have taught the German engineers the secret of cheap and effective freight traffic, and there is a demand for a new policy of larger and heavier rolling stock. . . . The American engines which have been thus far ordered and used in this country have been brought for purposes of study and experiment, and however efficient they may prove to be, it is, for obvious reasons, not to be expected that the German state governments will place any large contract for locomotives or other railway material with other than German manufacturers. Aside from the railways owned and managed by the several state governments, there are a number of small lines, generally of a secondary nature, which are owned and operated by private companies independent of any political obligation and ready to buy rolling stock where it can be obtained to the best advantage. Of the 18,291 locomotives in service in Germany in 1899, 17,491 belonged to the State railroads and 800 to private railway corporations. . . . It goes without saying, however, that the principal opportunity for American railway engines is in countries which, unlike Germany, France and England, have no adequate facilities for building them at home. Such opportunities exist most notably in Russia, Turkey and the Balkan States, where considerable railway construction is now in progress and still more projected. No locomotives are manufactured in Turkey or the Balkan States, where German capital is being invested and where important development is to be expected within the next ten or twenty years."

British Counterfeits of American Tools.

"Mechanical Progress," of Manchester, England, in an editorial upon "American Engineering Competition," says: "There is more than one firm of British toolmakers who are making tools for the agents here of American houses, which latter have no difficulty in selling them as American tools, although the firms who manufacture them here can place them on the market at 10 to 20 per cent. reduction in price, thus showing that in many cases prejudice is at the bottom of the purchase, although in the instance we are referring to, the tool is equally as well built as the American pattern."

If the tool should not happen to be as well built as the American of course America will get the discredit of it. It is not easy to see how either England or America can find much satisfaction in this counterfeiting game.

It is bad enough to copy, but much worse to copy and then sell as genuine. A man who will do it is not honest enough to build a good machine.

The firm of Merryweather & Sons, of London, is 200 years old, dating from 1690. The founders were Hadley, Simpkin and Lott, all noted engineers. Their first work was fire engines, which are still a specialty of the firm. Moses Merryweather entered the firm in 1802, and his descendants are still in it.

Our English contemporary, the "Electrical Review," seems to think that Europe is a united country and can act unitedly with regard to commercial policies. That trade between the various countries of Europe is as free and untrammeled as it is between the various States of the Union. Let us gently whisper to our contemporary that it is mistaken about this and that comparisons of the United States and "Europe" as though Europe were one united country are silly.

Commercial Review.

NEW YORK, Monday, Sept. 16, 1901.

MACHINERY AT HOME AND ABROAD.

Evidences multiply of an active demand for machine tools and other classes of machinery. The demand seems to be better sustained than in 1900 and better controlled than in 1899. There has, therefore, been no sharp or extensive change in conditions from fall to summer, since the activity of the market has at no time materially abated, yet reports are heard which show some expansion in the last six weeks. No unfavorable influence now bears heavily upon the situation. Strikes are virtually at an end for the present. The break in the stock market caused by the news from Buffalo was only a spurt of excitement. There is, indeed, some talk even in the machinery market of the unfavorable effect of President McKinley's death upon business, but there is little reason to fear that it will be borne out. Some apprehension exists as to the policy of the new Executive, but not sufficient to count for much in the absence of any act on his part disquieting to business and prosperity. The sentiment for a new tariff policy, tending even to the obliteration of old party lines, to which an impetus has just been given so dramatically will doubtless be seized upon by some of the professional advocates of extreme high protection for purposes of calamity howling to political ends, but it is unlikely that they can stampede the sober business men, least of all the machinery builders.

The contract for the entire equipment of power transmitting, elevating and conveying machinery of the new 4,000,000-bushel grain elevator of the New York Central system at Weehawken, N. J., has been let to the Webster Manufacturing Company, of Chicago. Geo. M. Moulton & Co., of Chicago, were awarded the general contracts for the elevator some time ago, as previously noted. It is understood that the railroad is now taking bids directly for the power plant, which will be an electrical one.

While reports from Germany are pessimistic in the extreme and the situation for some of the tool manufacturers in that country seems to be a critical one, the English market, though not active, is in relatively good shape for American tool builders. A prominent machinery exporter said the other day that export trade in this line was looking better for his concern than during some six months past, and that the improvement was chiefly in England. He remarked, however, that this might be taken with allowance, since the machinery business of the firm has of late been extremely flat. We learn also that the Acme Machine Screw Company has just booked some good English orders coming through the Prentiss Tool & Supply Company.

Yet if the British Westinghouse contracts were eliminated the English trade would not on the whole be anything to boast of. There seems to be no end to the orders from this concern which are coming to light. The last we have heard of were for a gear cutter and some 16-inch extension base shapers which are being built by Gould & Eberhardt, Newark, N. J. Gould & Eberhardt machines have been exhibited at Glasgow by the English and Scotch agents of the firm and some recent English demand which has arisen is ascribed to the results of the exposition. It is encouraging to note that the firm find domestic trade very active, the demand being quite steady but rather heavier since the first of August and running notably to the line of shapers and large gears.

Specifications have reached a party in the New York market for a machine shop equipment to go to Yokohama, Japan. It is said to appertain to some important work in that country. We have not heard a definite estimate of the value of the tools called for, but it is thought that they may reach $50,000.

The Japanese house, Takata & Co., at 10 Wall street, New York, has lately placed contracts for quite a large quantity of machinery for the Japanese market. It has ordered a plant to be installed in the Shiramine Dockyard, which will include two vertical cross-compound condensing Westinghouse engines of 275 horse-power each, two 150-kilowatt direct-current Westinghouse generators, a number of motors, Heine water-tube boilers, a Knowles horizontal air-pumping and jet condenser equipment, a Wainwright water-tube feed water heater equipment made by the Taunton Locomotive Works, etc. The entire amount of these contracts is estimated at $50,000. Another contract was placed for a Westinghouse generator, motor, etc., for furnishing power to ventilating apparatus in the Tokio House of Commons. Still another is for a Lidgerwood hoisting equipment and Westinghouse motor for installation in the Ashio copper mine. The hoist will have a friction drum of 30 inches diameter and 24 inches face. Orders for machine tools are occasionally coming through Takata & Co. At present they have one, not yet given out, which will call for a projectile making machine. The Japanese situation is favorably viewed at their office. The Japanese financial horizon is looking brighter and a good trade in the next six months is anticipated. Among the classes of manufacturing equipment for which there is a demand in Japan is that for paper making.

The J. G. Brill Company, of Philadelphia, is to establish a plant in England for the manufacture of car trucks for the British and other European markets, and it is believed that everything in the way of equipment will be purchased in the United States. J. A. Brill has for several months been in Europe making arrangements for the plant and is expected back September 25.

Reports have recently been made of the award of contracts for the electrical equipment of the Great Northern & City Railway of London and the Auckland Electric Tramways Company, Ltd., the former being secured by the British Thomson-Houston Company and the latter by J. G. White & Co., of London. In the former case four 800-kilowatt main generators of the General Electric type, besides other electrical equipment, were said to have been decided upon and engines of an English make—the Musgrave. In the latter there were three 300-kilowatt General Electric generators and engines of the British firm of Cole, Marchent & Morley, Ltd. We are given to understand by a person whose statement counts for a good deal in the matter that these reports seem to be premature or not altogether trustworthy. Some mention of them, however, seems in order, as there is probably a substantial

MACHINERY, MACHINES, AND PARTS OF—	JULY— 1900 Number.	JULY— 1900 Dollars.	JULY— 1901 Number.	JULY— 1901 Dollars.	SEVEN MONTHS ENDING JULY— 1899 Number.	1899 Dollars.	1900 Number.	1900 Dollars.	1901 Number.	1901 Dollars.
Cash Registers	545	40,441	696	53,881	.. ..	.....	....	435,511	5,587	461,450
Electrical	.....	497,542	.....	393,077	.....	1,598,039	.....	3,040,273	.....	3,462,299
Laundry Machinery	.....	47,463	.....	40,683	.....	31,808	....	306,193	.....	302,735
Metal-working	.....	558,639	.....	227,732	.....	3,860,116	.....	4,238,736	.....	1,751,548
Printing Presses, and parts of	.....	80,730	.....	53,743	.....	518,049	.....	721,672	.....	405,235
Pumps and Pumping Machinery	.....	206,173	.....	116,203	.....	1,724,839	.....	1,779,596	.....	1,126,560
Sewing Machines, and parts of	.....	364,861	.....	313,165	.....	2,193,883	.....	2,679,343	.....	2,213,089
Shoe Machinery	.....	79,620	.....	110,583	.....	512,833	.....	685,950	.....	646,882
Steam Engines, and parts of—										
Fire	1	600	.....	.....	3	13,713	4	7,380	4	5,525
Locomotive	32	385,618	23	143,513	256	2,224,360	313	3,312,463	291	2,640,837
Stationary	174	101,035	111	52,070	440	243,487	801	473,951	761	453,365
Boilers and parts of Engines	.....	181,526	.....	91,733	.....	663,618	.....	1,016,282	.....	767,476
Typewriting Machines, and parts of	.....	208,743	.....	220,858	.... .	1,678,937	.....	1,604,291	.....	1,707,300
All other Machinery, and parts of	.....	2,035,358	.. ...	1,515,589	.....	11 096,491	.....	13,850,249	.....	10,352,786

UNITED STATES EXPORTS OF MACHINERY OF DOMESTIC MANUFACTURE, INCLUDING JULY, 1901.

foundation to them at least. For tool builders the most interesting item of the contracts for the London road is a repair shop equipment, including lathes, shapers, drills, wheel press, etc. If these are purchased they will very likely be of American make.

SOME NEW SHOP ENTERPRISES OF MACHINERY BUILDERS.

The Lodge & Shipley Machine Tool Tool Company, Cincinnati, Ohio, has purchased additional ground on which new buildings will be erected.

The Abendroth & Root Manufacturing Company (office, 99 John street, New York), whose water-tube boiler and spiral riveted pipe works in Brooklyn were burned a few months ago, has purchased the former Wright steam engine works in Newburgh, N. Y., and is fitting them up for the manufacture of the lines named. The company will also do a general machine shop business and build steam engines, having purchased the Wright company's patterns and shop equipment—which is said to be an excellent one—along with the plant. The works are located on a plot of about 12 acres. The Abendroth & Root Manufacturing Company is putting up two additional buildings. It has ordered a new equipment of machinery for spiral riveted pipe manufacture; this is of rather a special character. A new equipment of machinery for boiler work which is more general in character and is largely hydraulic is yet to be ordered. It is intended to employ electric driving in the works to a considerable extent and the company already has the power plant and dynamo to furnish current. About 300 men will be employed in the establishment. A beginning of manufacturing work is expected to be made in about thirty days, but it will be considerably longer before all departments are in operation. If the company had not lost its Brooklyn works it could have kept them running of late twenty-four hours a day without difficulty, the demand being especially heavy for spiral riveted pipe.

The Phœnix Iron Works Company, of Meadville, Pa., have found their business increasing to such an extent as to necessitate the enlargement of their facilities. A contract has been given to the Penn Bridge Company, of Beaver Falls, Pa., for the structural work of a new boiler shop which will more than double their present capacity. It will be equipped with the most approved modern machinery and thoroughly up to date. They are also building an addition to their foundry, which will largely increase the capacity. The capacity of the engine department is also to be increased.

GERMAN DUTY ON EMERY WHEELS.

Consul-General Mason reports from Berlin August 16 that a recent decision of the imperial German customs office reclassifies emery wheels and doubles the duty hitherto levied on that class of imports. German-made emery wheels are usually manufactured of pure corundum, the hole which is pierced through the center of the disk fitting round the shaft or spindle without any metallic support. As a consequence, it happens that such a wheel sometimes works loose on the shaft as a result of disintegration from vibration. To prevent this, American manufacturers of emery wheels are accustomed to line, or "bush," the central orifice with Babbitt metal, iron or some other metal that will give a firm seat to the shaft. Hitherto these "bushings" have been generally covered with a label bearing the name of the maker, size, number, etc., and the metallic portion thereby concealed. Recently, however, this has been discovered, with the result that emery wheels so provided with bushings are classified for duty as metal in combination with corundum (Schmirgel), which increases the rate from 3 marks to 6 marks ($1.42) per 100 kilograms. This rate will not seriously affect the trade in the smaller sizes of wheels, but as they are made and used in all diameters up to 3 feet, the increased duty will have a tangible effect on the net cost of the larger sizes.

CHICAGO MACHINERY MARKET.

It is the general report among electrical men that trade continues brisk. Several representatives of large motor and generator makers say they are obliged to turn down quite a number of orders because they cannot make the deliveries wanted. One of these representatives says that today he had to decline an order for a 400-kilowatt generator because shipment was asked in ninety days. Still there is keen competition for most of the business that is current and prices are not so well held as the activity of the market would seem to indicate they should be. Manufacturers are among the best buyers of electrical machinery and the amount of inquiry has not decreased perceptibly from what it was one, two or three months ago. The present keenness of demand means in part that installations are desired before the close of the year.

The Lake Shore Railroad has placed orders with the Crocker-Wheeler Company for seventy motors, ranging from 5 to 35 kilowatts each, the total aggregating about 750 horse-power. These are intended for the machine shop now under construction at Collinwood, Ohio, for which a 400 kilowatt generator was bought several months ago, delivery to be next February. Car, boiler and wood-working shops are also to be erected at Collinwood by the Lake Shore and equipped with electrical power later. It is the expectation that all the motors now bought can be operated by the one 400-kilowatt generator, for the motors will not be in operation at one time. These Lake Shore shops, when completed, will, it is said, be among the finest in the country. It is the expectation to concentrate there all the repair shops of the system.

The Allis-Chalmers Company has purchased for its Milwaukee plant one 100-kilowatt generator from the Crocker-Wheeler Company. Later a 500-kilowatt generator and a large number of motors will be ordered for the same plant.

Two large cement works in Michigan have closed for electrical equipments, both being secured by the Westinghouse company. They are the Hecla Portland Company, of Bay City, and the Peerless Portland Cement Company, of Union City. The equipments each consist of two 400-kilowatt generators and a large number of motors ranging from 20 to 75 horse-power. Another large contract recently placed was that of the Ashland Iron and Steel Company, of Ashland, Wis., for two 250-kilowatt generators and a number of motors, running up to 35 kilowatts.

The Northern Electrical Manufacturing Company sold to the Inland Steel Company, Indian Harbor, Ind., two direct-connected generators of 300 horse-power each and a complete motor equipment. The plant of Deere & Mansur, Moline, Ill., wherein there has just been installed an equipment by the Northern Electrical Manufacturing Company of 1,000 horse-power, one of the largest direct-connected industrial equipments in the West, will start up next Monday with the new power.

Quotations.

NEW YORK, Monday, Sept. 16.

Pennsylvania Foundry Pig Irons, Jersey City delivery:

No. 1 X	$15 15 @ $15 65
No. 2 X	14 65 @ 15 15
No. 2 plain	14 15 @ 14 65
Gray forge	13 50 @ 14 00

Alabama Pig, New York delivery:

No. 1 foundry, or soft	15 00 @ 15 25
No. 2 foundry, or soft	14 25 @ 14 50
No. 3 foundry	13 75 @ 14 00
Foundry forge, or No. 4	13 25 @ 13 50

Bar Iron—Base sizes—Refined brands, mill price on dock, 1.63c. incarload lots; from store, 1.90 @ 1.95c. in small lots.

Tool Steel—Base sizes—Good standard quality, 7c.; extra grades, 10c. and upward.

Machinery Steel—Base sizes—1.90 @ 2.00c. from store.

Cold Rolled Steel Shafting—Base sizes—From store, 2½ @ 2¾c.

Copper—Lake Superior ingot, 16⅝ @ 16¾c.; electrolytic, 16⅜ @ 16⅝c.; casting, 16 @ 16⅜c.

Pig Tin—About 25½ @ 25¾c. spot for 5 and 10-ton lots, f. o. b.

Pig Lead—For wholesale lots, 4⅜c., with .02½ @ .05c. extra for carloads.

Spelter—4.10c.

Antimony—Cookson's, 10¼ @ 10⅜c.; Hallett's and U. S., 8½c.; cheaper brands, 8¼ @ 8⅜c.

Lard Oil—Prime City, 74 @ 75c. in jobbing lots.

Compulsory Arbitration in New Zealand.

Though we do not at all favor compulsory arbitration, nor believe that it is practicable here, we have published some references to it, and especially to its employment in New Zealand. Recently it has been charged that the Premier of New Zealand had admitted that the law was a failure and would have to be abandoned and therefore a letter addressed by Henry Demarest Lloyd to the "Evening Post" of New York on this subject is of interest. Mr. Lloyd writes:

"Your correspondent, Howard Dunham, in writing about compulsory arbitration, quotes from the Louisville 'Courier Journal' a statement that Mr. Seddon, Premier of New Zealand, has recently admitted that the law is a failure, and has declared its abandonment to be 'imperatively demanded in the interests of industrial peace.' Mr. Seddon has never said this nor anything resembling it. The Louisville 'Courier Journal' and a number of other American papers have been deceived by the London 'Daily Mail,' which was itself deceived by a dispatch from Sydney, New South Wales. The news was what is known in the profession as a 'fake.' Getting New Zealand news from Sydney is as if Paris should get its English news from Dublin. By cabling direct to New Zealand for confirmation of this incredible report, the London 'Daily Mail' learned that Mr. Seddon had not said anything against the law, but had only warned the workingmen of the dangers of overworking the court, as Mr. Reeves and other friends of the experiment have frequently done.

"Interestingly enough, the truth is the exact opposite of the fake set in circulation through the London 'Daily Mail.' At the very time it described him as demanding the abandonment of the Arbitration Law, Mr. Seddon was pushing through the New Zealand Parliament a bill to extend, strengthen, and improve the law. His language in doing so was the precise antithesis of that attributed to him. Your correspondent quotes him as declaring that arbitration, instead of preventing strikes, had provoked them, and had caused the workingmen to grow more discontented and contentious. In the 'New Zealand Hansard' of July 11, which I have before me, I find that what Mr. Seddon did say, and he said it in direct reference to the Arbitration Law, was this: 'There has never been a better feeling between employer and employee than at the present moment. I say it advisedly. . . . I should know as Minister of Labor if there was any antagonistic feeling between the two. Taken on the whole, I say there is no reason to complain of what has been done by the Legislature.' Instead of demanding the abolition of the law, as falsely reported, Mr. Seddon said: 'What we want to do is to make the law as perfect as we can.' Mr. Seddon ended the debate by pointing out, in answer to loose assertions of injury done to industry by the labor legislation of New Zealand, that 'during the time of this legislation—during the last eight years—the number of employees in the factories of the colony has doubled.'

"Indulge me in one word as to the merits of the question. I am not arguing for the adoption of compulsory arbitration by the American people who do not want it; not at all. But I would like to help the Labor Barons and the Capital Barons in making the people want it, which is quite a different thing."

Echoes from the Oil Country.

A DESIRABLE CURVE.

Some people wonder how some people manage to get along without much knowledge. If I had a chance to divide up the room in my head between knowledge and judgment I would try to fill the most of it with judgment. While a little knowledge may be dangerous, I am not sure that poor judgment is much better.

That corn-sheller business is beginning to crowd, and I can see that we must have some new tools, and I would like to be sure what it is best to get. If I could only take one of those nice diagrams with the curves on it and plot out the ordinates and abcissa that fit my case, and so see what kind of a machine was indicated, and, if it was a general formula, apply the "Interferometer" to each one and see just how many wave lengths they came from perfection as money-savers, I could easily pick the right one, and, between borrowing some money and getting time from the seller, I would soon have one in and running.

My friend who is trying to sell me a 65-inch lathe to build my work on evidently knows all about it and what it will do, and I don't doubt him a minute when he tells me of the big bag of dollars it is saving for his friend the superintendent over the way; not a bit of it. But I do know more about my work than he does, and I, in some way, fear that the curve formed by joining his machine with my work would not be considered very beautiful by a good judge of those things, and I have found some people who could use their pocket book in such a way as to act as a very good micrometer. It is very distressing when the curve produced by the various accounts of the shop ledger happens to turn the wrong way.

Yes, I could turn up a great big pulley in that lathe after the foundry cast it, and it wouldn't take much longer to rig up and cast it and turn it than it would to get one from Buffalo, nor cost more than twice as much. It would be a good machine for raising Sammy's muscle in handling it on small work, only I am not running a physical culture school; and if I were, that would be too expensive an apparatus. Evidently, to save dollars for me, that 65-inch lathe would have to bring them along when it came.

This case is comparatively easy to differentiate, but some of them are not. I think a 16-inch lathe with an 8-foot bed would nearly suit me. That Buffalo man says his is the one; latest design, best material, finest workmanship; can't be touched by anything else on the market; being put into all the good shops, etc.; while the Pittsburgh man says some people are always jumping around and hollering "New, new," because no one would keep anything of theirs long enough to let it get old; while with them, years of use, hard work and severe testing have demonstrated that it is right, etc. The Cleveland man has avoided all the mistakes of the past and has embodied in his machine much of the wisdom of the future, and while his lathe has all the good points, it is lacking in all the bad points of all of them, and so forth and so forth.

Now, while I just imagine I am doing my work on each one of them, I must try to figure out just what kind of a cost curve is produced, and as my points on the curve are located by judgment instead of by knowledge, I must go a little slow. Knowledge will have her innings anyway after I get the tool. The salesman assured me that I could finish up certain pieces in 8 minutes and 49½ seconds, that Blank & Blank are doing a piece just a very trifle bigger in that time. Of course I must have true, soft castings with all the sand removed. My curve on this job is away down, and I wish I could run some that would show just how much drop is due to hard castings, how much to rough uneven ones, how much to sand, how much to poor workman on the machine and how much to the hopeful spirit of the salesman.

These curves are quite (comparatively) easy to produce after I have the machine and have carefully tested each point. That is the knowledge curve. The judgment curve is always harder to make, and I often dislike to put it up alongside of the other, as they don't look as much alike as would be flattering.

Any mechanic who is not satisfied with his present pay (and I have reason to think that a few such can still be found), and who wants to know the quickest way to increase it, should try to work out these judgment problems. When he becomes proficient at it he can get almost any price. Some claim the president of the Steel Trust gets a million dollars a year at it. Most of us could not find time to spend that much, but neither could we keep the strings from getting tangled. Why, it's hard work to keep Sam and Joe from fighting about which tool is best for a job, and the youngest cub and the helper from trying to make the other one wheel out all the chips; while to make the charge curves just as large as they can be and still make the customer feel he is getting full value received is quite a fine operation where each job is the first of its kind and generally the last, too. Most

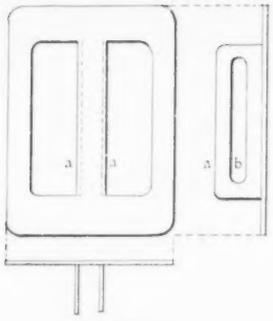


Fig. 1
First Operation

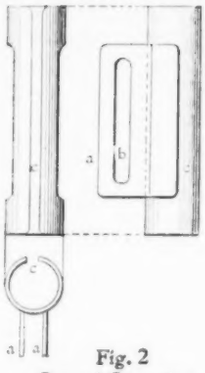


Fig. 2
Second Operation

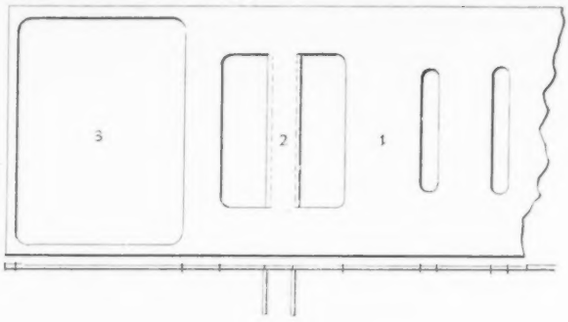


Fig. 3
A Section of Stock as Punched
Showing Successive Operations

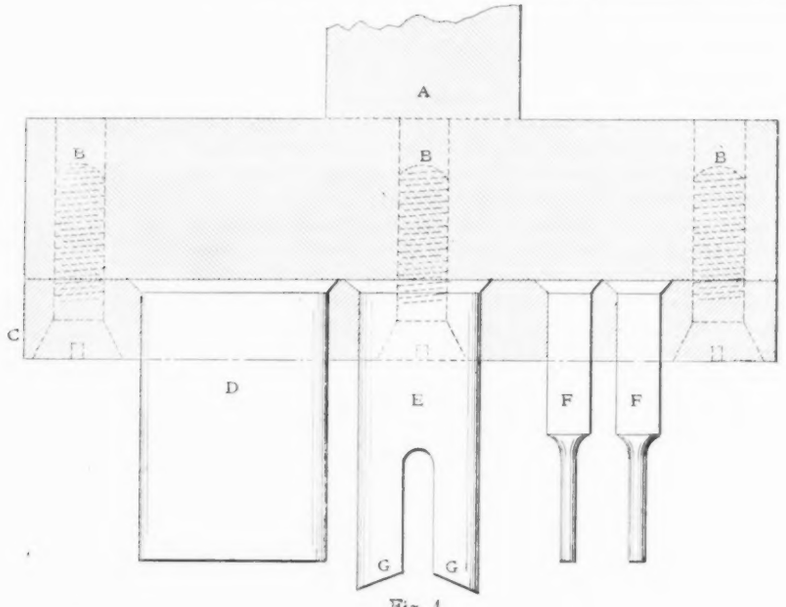
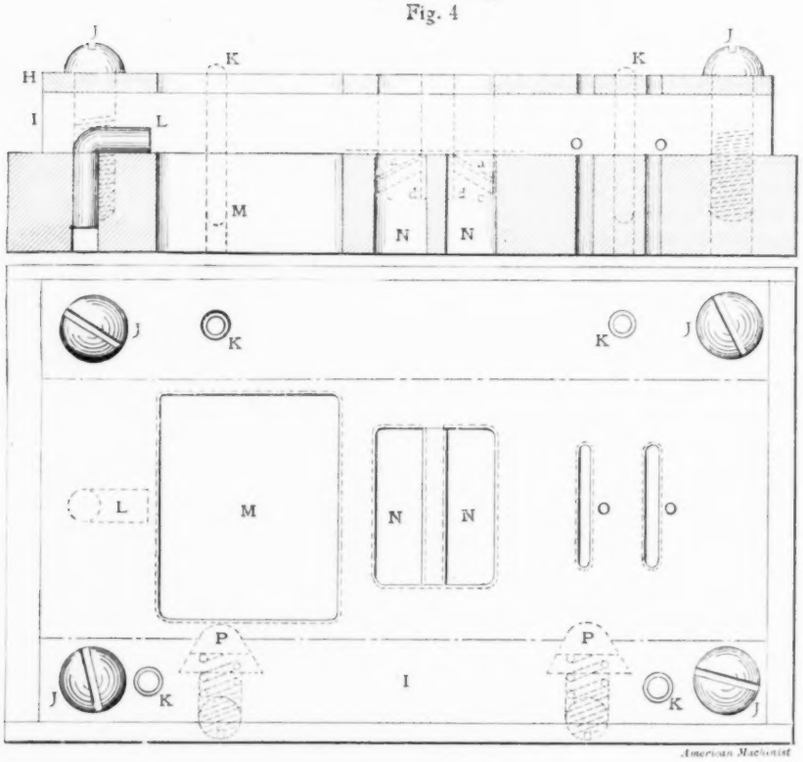


Fig. 4



SECTION OF PUNCH AND DIE AND PLAN OF DIE FOR PIECE, FIG. 1.

of them have variations of their own. I suppose some of the higher-mathematics folks would class them as variables and apply the calculus to them; I can only make an attempt with the judgment curve.

W. OSBORNE.

Dies for Making a Sheet Metal Ferrule.

BY WILLIAM DORAN.

For the production of sheet metal novelties in large quantities it is often possible to design a die that will accomplish in one operation that which usually requires two or three, and as the saving of two, or even one operation in the production of sheet metal parts which are very often turned out to the million mark, adds considerable to the margin of profit, the dies which will produce them in the shortest time are the ones to use.

In the following article the dies described and illustrated are of this class, and produce in two operations results which, were dies of a simpler design and construction used, would require four. The dies—two in number—of the "gang" and "automatic slide" type respectively, are for producing the circular-formed piece shown in the three views of Fig. 2, with two outstanding wings at *a a*. The metal used was thin spring brass, and the piece when finished was used as a sliding bracket on a compass attachment, the circular portion *c* being so finished as to have enough spring to allow it to hug tightly the part on which it was to slide. The first operation on the blank is shown clearly in the three views of Fig. 1, and, as will be seen, consists of piercing the two slots *b*, cutting and bending the wings *a a* and punching out the finished blank. The manner and relation in which these operations follow each other through the die is shown in Fig. 3, which shows a section of stock as punched at one stroke of the press, 1 being the pierced slots, 2 the wings as cut and bent, and 3 the hole left by punching out the blank.

The punch and die for producing this blank are shown in Figs. 4 and 5, Fig. 4 showing a longitudinal cross-section of both, and Fig. 5 a plan view of the die, in which can be clearly seen the tension buttons *P P* which are used to keep the stock firmly against the back gage plate as it is fed along, and which were shown and described as used on a piercing and blanking die in a preceding article of mine.

As the stock to be punched was quite thin, and had to be produced with clean, nice edges at all points, perfectly free from burrs and fins, the punch and die had to be constructed accurately; and as the article was to be produced in large quantities, it was necessary to finish both in a manner favorable to their longevity. The method of construction followed out in the die can be clearly understood from the cross-sectional view of Fig. 4 and the plan view, Fig. 5; *O O* being the piercing dies, *N N* the cutting and bending dies for the wings, and *M* the blanking die. When laying out, spacing and finishing these, great care was taken to space them correctly and finish each in the proper relation to the others. Very little clearance was given, finishing them almost straight, in order to allow of the die being ground without changing the shape and size of the blank to any extent. As the two wings *a a* of the blank, Fig. 1, are cut and bent into the dies *N N*, the gage plates *I I* of the die are required to be of unusual hight to allow of the stock being fed along with ease. These gage plates, together with the stripper plate *H*, are fastened to the die by the screws *J* and located by the dowel pins *K* in the manner shown in the plan view. The holes in the stripper plate for the two piercing punches are finished dead in line with the dies *O O*, and so as to be a tight fit for the punches, which, being rather frail, would not stand up well if they were not strengthened in this manner. The inside of the dies were all finished as smoothly as possible and polished before and after hardening. After hardening (which was done in water with a 2-inch surface of oil) the face of the die was ground, and then tempered on a hot plate to a light straw temper, and then oilstoned to a keen edge at all cutting points.

The construction of the punch is clearly shown in the cross-section, Fig. 4, and includes the usual cast-iron holder *A*, the machine steel punch pad *C*, into which all punches are located and fastened by upsetting at the back, and the flat-head screws B (of which there are six) for fastening the pad to the holder. As shown, the punches *G G*, for cutting and bending the wings *a a* of the blank, are of one piece of steel *E*, which has a slot through the center and half-way up its length, to separate the two punches. In thickness these punches are finished one thickness of metal less than the dies *N N*, and have the faces sheared to the angle shown, and the inner edge slightly rounded—that is so that as soon as the punches commence to cut, they will start to bend also, and as soon as the entire face of the punches have entered the die, the wings will have been bent down straight, as shown in the blank. The dotted lines within the dies *N N* show this operation clearly. At *a a* the punches have commenced to cut and bend the wings; *c c* show the faces of the punches when they have entered the dies the full depth, and *d d* the wings as bent and finished. All of the punches were hardened, and the blanking punch *D* and the two piercing punches *F F* drawn to a dark-blue temper. The cutting and bending punch *G G* was tempered differently. It was first heated and hardened in clear oil, dipping it from the back, and thus preventing—as far as possible—the two legs *G G* from crawling in towards each other because of the channel between them. By dipping from the back this was overcome, as by the time the cutting face was immersed the back was hard and set. It was then polished and tempered by drawing from the back to a dark blue to within ¼ inch of the cutting faces and quenched when these portions were a dark straw color.

The punch and die for the forming and finishing operation, is of a more intricate and elaborate type than the one used for producing the blank, and as there are a number of practical points in its construction which are essential to the successful production of the work, it is of sufficient interest to warrant a detailed description of its principal working parts. The punch and die as used when in operation are shown in Fig. 7, which shows a longitudinal cross-section of each, with the blank in position for forming. The die consists of a rather heavy cast-iron bolster *R*, which is finished with a dovetailed channel down the entire length of its face, and with a central channel at right angles to the first to admit the forming die *N*. This die is of tool steel and is shown in a plan view, as are all the other working parts of the die in Fig. 8. It is finished on the face in a half circle of the radius to which the blank is to be formed and has two narrow slots sunk in it, to accommodate the wings of the blank, as shown at *N*, it is hardend and slightly drawn, and then ground to the size shown to a nice fit in the channel. Before hardening a hole is let into the center of the bottom to accommodate the adjusting stud *V*, Fig. 7. A hole is drilled straight through the bolster at this point and enlarged and tapped at the back to admit the spring case screw *T* and the spring *S*. By using these parts as shown, the tension of the spring can be regulated, as can the hight of the punch *N* also.

The two forming slides *K K* are of flat tool steel of the thickness shown and are finished in the following manner: A piece of steel long enough for both slides is first planed all over and fitted to the dovetailed channel in the face of the bolster, fitting it tightly. It is then strapped to the table of the milling machine, with the sides at dead right angles with the cutter, and a half-round groove of exactly the same radius as that in the face of the die *N* let in, using the graduated dial on the table feed screw to get the depth correct, and feeding very slowly with a good flow of oil on the cutter, to get as smooth a finish as possible. This done the forming cutter is removed and a sharp saw 3-32 inch thick substituted in its stead, setting it in the dead center of the half-round groove in the work, and feeding it through to within 3-32 inch of the table. The work was then removed and the two sections separated. The faces of each were then nicely finished and polished. This method of finishing the forming faces of the slides insured their alinement with the forming portion of the die, and with each other. The angular-faced cam portion in the end of each was then finished,

as shown at *I I*, to templet, finishing the faces to an angle of 25 degrees with the slide face and polishing them as smooth as possible. After the screw holes for the gage plates *L L* and spring screws *Q* were let in in the positions shown, the slides were hardened at the wearing surfaces and drawn slightly, leaving the remaining portions soft. They were then ground on the sides to fit nicely within the channels in the bolster—that is, so that they would slide freely without side play.

The punch, as shown in Fig. 7, consists of seven parts; the holder, or body *H*, forged from mild steel, the two slide cams *J J* of tool steel, the forming punch K of the same material, the punch stud *F*, the adjusting nuts *E*, and the spiral spring *G*. The holder or body of the punch H, after being chucked and faced, and the hole for the spring *G* and stud *F* let in, was strapped to the lathe face-plate and the stem trued with the hole, then turned and finished, as shown, and the back faced. It was then set up on the milling machine and the sides and ends milled, and a channel let into the face to admit the forming punch *K*. The finishing of this punch was a nice milling job, as it serves when finished as the punch for forming the bottom of the blank and also as the horn for the slides. The method of finishing was as follows: A piece of annealed tool steel large enough all over to allow of finishing the punch to the shape shown in Fig. 7 and in the two views of Fig. 6 was first centered, as shown in both views of Fig. 6. It was then placed on the lathe centers and a narrow shoulder turned at each end in diameter exactly one thickness of metal less than that of the die. We now had two reliable points to work from. The

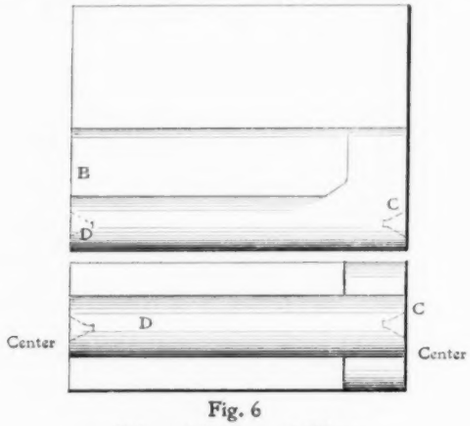


Fig. 6
Side and Underneath Views of Forming Punch

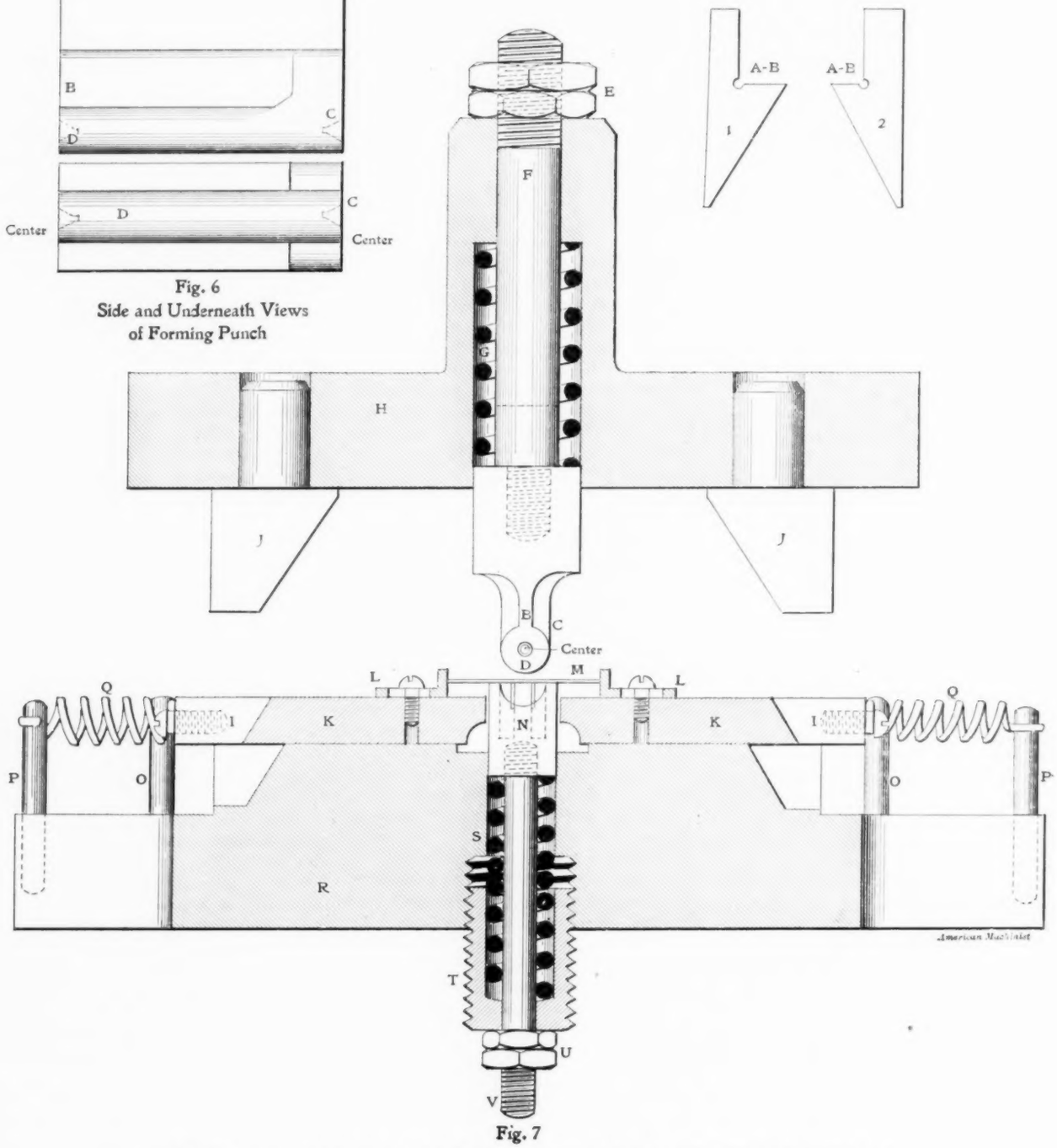


Fig. 7

FIG. 7. SECTION OF PUNCH AND DIE FOR FORMING AND FINISHING TO SHAPE OF FIG. 2.

punch was then set on the miller centers, jacked up from the bottom and the portion *D* finished with a narrow mill to the same radius as the ends before mentioned, finishing the punch in a perfect radius to within 3-64 inch of each side of the center, and ending in a stout wall at the back *C*, running out and ending in a fillet as shown. It was necessary to have this wall at the back, because of the frailness of the central wall *B*. By moving the punch around the miller centers and locating and fastening as required, the back of the punch was milled true with the face. The punch was then removed from the centers and held in the vise and the sides milled to fit the channel in the holder, finishing both sides equidistant from the center of the punch face. As will be seen, this was about as accurate and expeditious a method of the finishing of the punch as could be adopted. The circular portion of the punch was then draw-filed, taking off all high spots, and giving the surface a perfectly symmetrical appearance. The two ends were then milled down and squared with the back strip of the metal used between them. The two slides *K K* were then moved in until the face of each rested snugly against the central wall of the punch at *B*. A pair of sheet-brass templets were then made, with an angular edge to rest against angular faces of the slides, and in length sufficient to extend up into the holes in the punch holder for about half an inch. The face of each templet was then filed back until the portions which extended up into the holes and that which shouldered against the face of the holder respectively rested squarely at all points, and the angular edge of the templets coincided perfectly with that portion of the slides. The templets were then marked and also the holes, and we now had a gage or templet to which to finish the equiangled faces of the slide cams. This can be clearly understood from the drawings of the templets in the upper right-hand corner of Fig. 7. The templets are numbered 1 and 2 respectively. To finish the angular face of the slide cams, the distance is found from *A* to *B* of the templets and the face of the cams finished so that the extreme point is the same distance from the side of the stud-portion as from *A* to *B* of the templet. The cams were hardened and drawn to a dark blue, and driven into the holder in the positions shown.

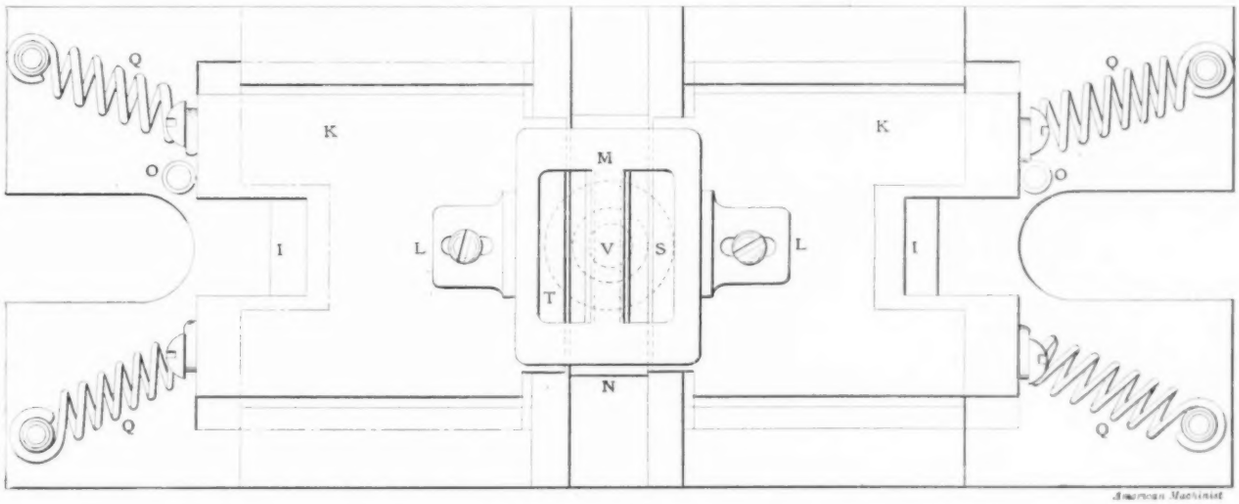


FIG. 8. PLAN OF SLIDE DIE.

and sides, the hole for the punch stud *F* was let into the center of the back and tapped, and the punch hardened, polished and drawn to a dark blue, and laid aside until the other portions were finished.

The two slide cams *J* were of tool steel, with one end of each turned to fit the holes in the holder, as shown. These holes were not required to be located with any great degree of accuracy, but were drilled and reamed in the approximately correct positions, and the angular faces of the slide cams located and finished in a very simple and expeditious manner, which was as follows: The forming punch, together with the stud and spring, was assembled within the holder *H*, as shown, and also all the finished parts of the die. They were both set up in the press, and the punch brought down until the forming punch had bottomed, and the die *N* as well, setting the punch dead central within the die by placing a narrow

After the gage plates *L L* were finished and fastened as shown, the stop pins *O O* were located so that when the slides were back at their extreme point, the blank would rest central on the die between the gage plates *L L*, as shown at *M*. The springs *Q*—two to each slide—were then made and fastened as shown, and the die was complete. The manner of operating can be clearly understood from Fig. 7. The blank is placed on the die as shown at *M*, and the punch set. As it descends the blank is formed into the die *N*, the spring *S* in the die being strong enough to allow of this being done without moving the die. As the punch forms the blank, the die descends until it bottoms. The forming punch now remains stationary, and as the holder continues to descend, the slides commence to move in, by means of *J J*, until the sides of the blank have been formed around the punch, and the face of each slide presses tightly against the wall *B*. As the punch rises, all parts return to their respective positions, and the finished work is slid off the punch by hand.

When dies for producing work of the type shown are designed and constructed in this manner the results will be all that can be desired. They will work well and rapidly, and, what is more, turn out the maximum amount of work before requiring repairs.

The Pan American Exposition—III.

THE WARNER & SWASEY COMPANY'S EXHIBIT.

The new tools exhibited by the Warner & Swasey Company are a 30-inch vertical turret machine and a manufacturing milling machine.

Two views of the turret machine are given in Figs. 9 and 10. Considered as a structure the leading features are the casting of the base and the column in one piece and the offsetting of the column with respect to the spindle center, this offset being such as to bring the center of the column in line with the cut on work of average diameter. The driving is by spur gearing attached directly to the face plate, the pinion being located directly below the tool—an arrangement which obviously relieves the spindle of much of the driving strain. The cross-rail is adjustable in hight to suit the work being done. The chuck face plate has both universal and independent movement to the jaws—the independent movement being, however, limited in range and intended for truing purposes only.

The machine has twelve speeds, obtained by a three-step cone, friction back gears and a two-speed countershaft. The

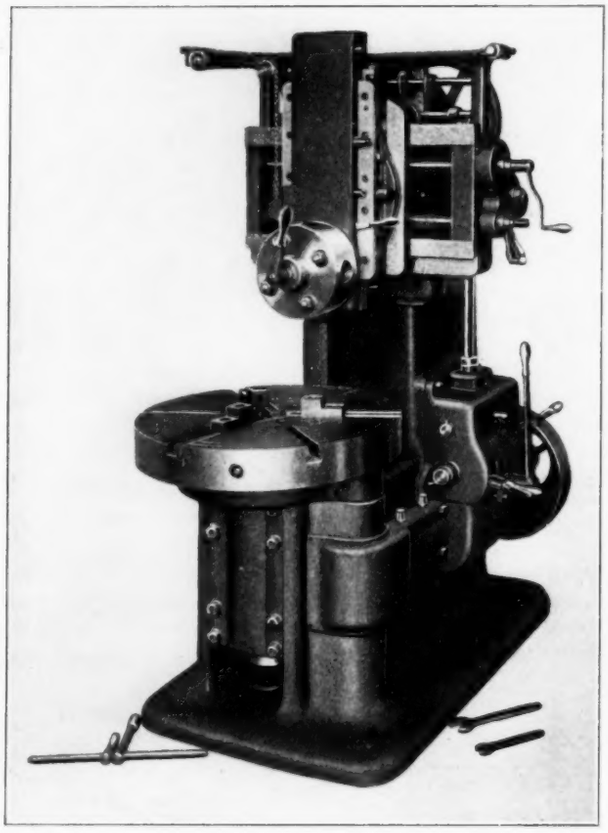


FIG. 9.

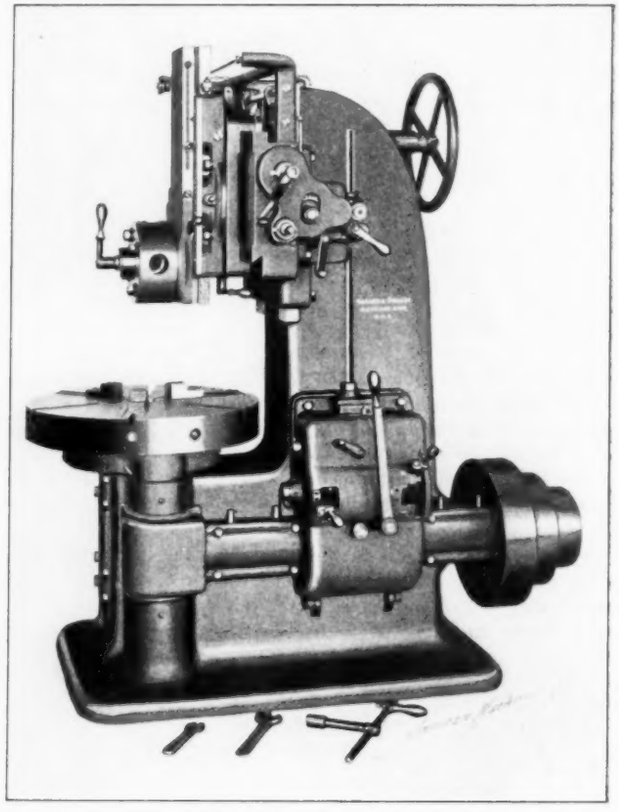


FIG. 10.

THE WARNER & SWASEY VERTICAL TURRET MACHINE.

back gears are operated by the vertical lever on the gear box near the cone pulley. Eight changes of feed are provided which are gear driven. The feed gears are permanently mounted, the changes being obtained by manipulating the levers which project from the two sides of the gear box, the machine being in this respect an example of a movement of this kind which was referred to in the first of these articles, and which first appeared commercially, I believe, on the Hendey Norton lathe. The feeds obtained by all positions of the levers are shown by a cast table attached to the machine. The feed screw and nut in the cross-rail have micrometer heads attached with adjustable indexes, so that the micrometers may always be made to read from zero. The small lever near the top of the gear box reverses the feeds. The same set of gears acts for both horizontal and vertical feeds, the levers which determine the direction of feed being at the end of the cross-rail. The vertical feeds include those necessary for cutting pipe threads. Adjustable stops are provided for throwing out both horizontal and vertical feeds and fixed safety stops at the limits of the motion avoid possibility of breakage of the feed gearing should the adjustable stops be left loose through neglect. An additional stop is provided which locates the turret positively in line with the table, this stop being, of course, intended for use in boring and reaming.

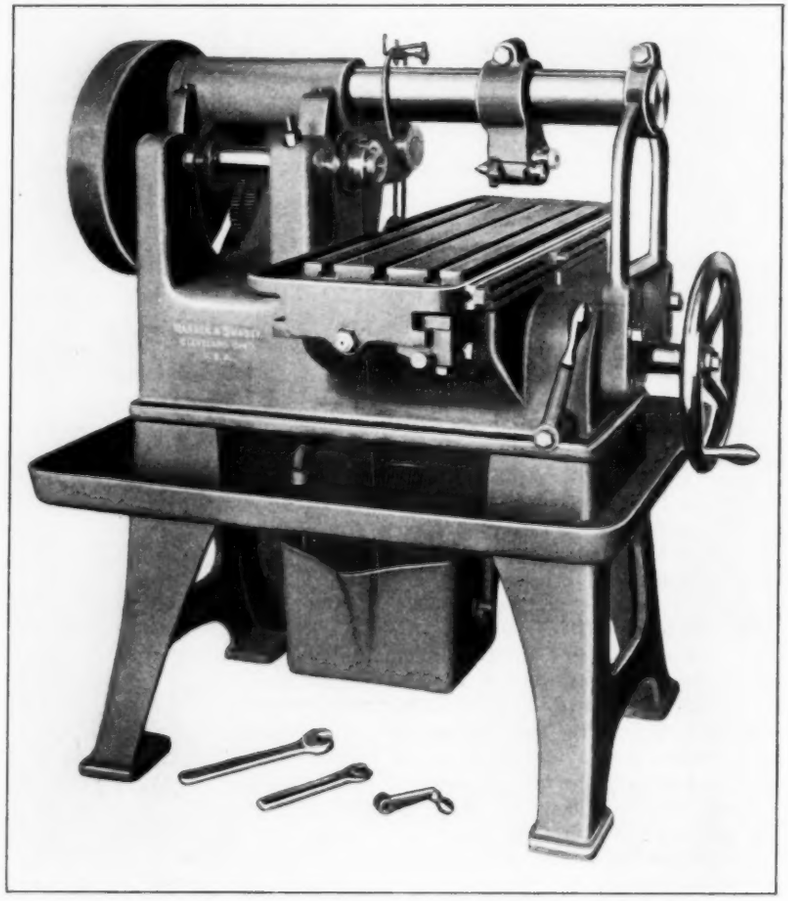


FIG. 11. THE WARNER & SWASEY MANUFACTURING MILLING MACHINE.

The manufacturing milling machine is shown in Fig. 11. It is, in general, of the Lincoln type, but is intended to be a more rigid and a higher grade machine than the Lincoln as usually made. The main spindle bearings and the overhanging arm are carried in a swinging casting which, to raise and lower the cutter spindle, pivots from the center of the cone pulley shaft. The webs which carry the spindle bearings are brought forward and terminate in segmental slides which fit corresponding recesses in the uprights from the bed. An elevating screw serves for making the adjustment, and pinch bolts bind the parts solidly together. With this construction it is obvious that the center distance between the driving gears is not disturbed in adjusting the hight of the cutter spindle. In order to increase the rigidity of the machine the usual slide by which the platen is adjusted lengthwise of the bed is omitted. A joint is thus saved, the platen is brought down close to the bed and is supported throughout most of its length by heavy brackets projecting from the bed, which carry the supporting guides well outward. To provide the necessary adjustment for the cutter lengthwise of the spindle, spanner nuts are provided on each end of the front bearing, which provide for ¾-inch adjustment, this being ample for this type of machine in which this adjustment is only used to bring the cutters into correct relation with the work. The uprights which carry the frame will be seen to be cast in one with the bed.

There are three changes of feed, which is gear driven, the gears being permanently mounted as in the turret machine with a knob handle, which is out of sight in the picture, for changing the feed. The outer support for the cutter arbor has both a plain center and a bearing fitted with a hardened steel bushing. An oil pump, pan and pot are provided, and the convenient means for dumping the latter, as well as the complete manner in which all gears are covered in both these machines will not be overlooked.

THE BULLARD MACHINE TOOL COMPANY'S EXHIBIT.

Several new features are shown in connection with the boring and turning mills of the Bullard Machine Tool Company, one of which—the provision of screw cutting feeds—is shown as applied to the small turret mill in Fig. 12. The geared feed is applied in a very neat manner by the addition of a vertical shaft between the two cone pulley feed shafts. The lower one of these shafts is gear driven from the main cone and the addition of the vertical shaft gives a positive feed throughout the train. The shaft may be disengaged and the belt feed used if desired, by the operation of an engaging cam of which the handle may be seen near the end of the shaft. The action of this cam is to withdraw the bevel gears from engagement.

The use of this feed is of course chiefly for the cutting of threads, and especially pipe threads in flanges. In range it cuts all standard threads between 4 and 12, including 11½. Automatic trips are provided for all feeds including a limit safety trip.

A new chuck is also shown, which, while universal in ordinary use, has also an independent movement to each jaw for purposes of adjustment. The adjustment is by a differential screw and is correspondingly fine and accurate. The jaws are removable and reversible.

A 44-inch mill has the ram of its left-hand head made hollow with provision for gripping a long boring bar, which is intended chiefly for use in connection with a steadying bush in the center of the table. By loosening this bar after the feed has run out, the ram may be withdrawn to the starting point, when, by regripping the bar, the feed may be resumed. In this way the machine will bore a hole the entire length of the highest piece of work which the machine will take in.

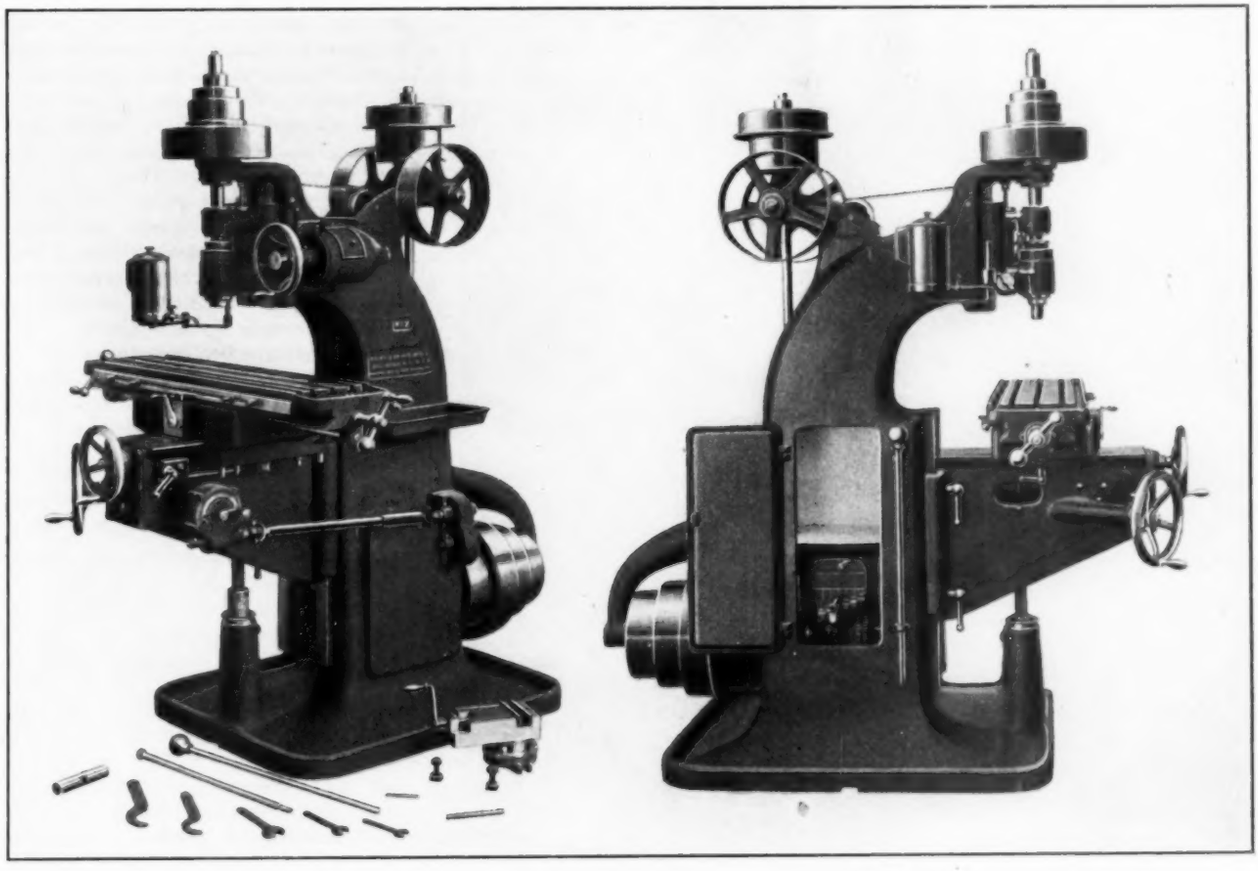


FIG. 13. FIG. 14.

THE BROWN & SHARPE MANUFACTURING COMPANY'S VERTICAL SPINDLE MILLING MACHINE.

THE BROWN & SHARPE MANUFACTURING COMPANY'S EXHIBIT.

The Brown & Sharpe exhibit contains much of interest, as the exhibits of this establishment at fairs always do. To me-

chanical men who are interested in precision work, the measuring machine is a leading attraction, especially as the Brown & Sharpe machine is not often seen outside their own works. Following a different policy from the Pratt & Whitney Company, the Brown & Sharpe machine is not, we believe, made for sale. The Pratt & Whitney and the Brown & Sharpe stands are directly opposite one another on the main aisle, and an unusual opportunity exists for comparing the differences in the two machines. These differences are in some respects radical and fundamental, but as both machines are familiar to the readers of the "American Machinist," it is unnecessary to enter upon a description here.

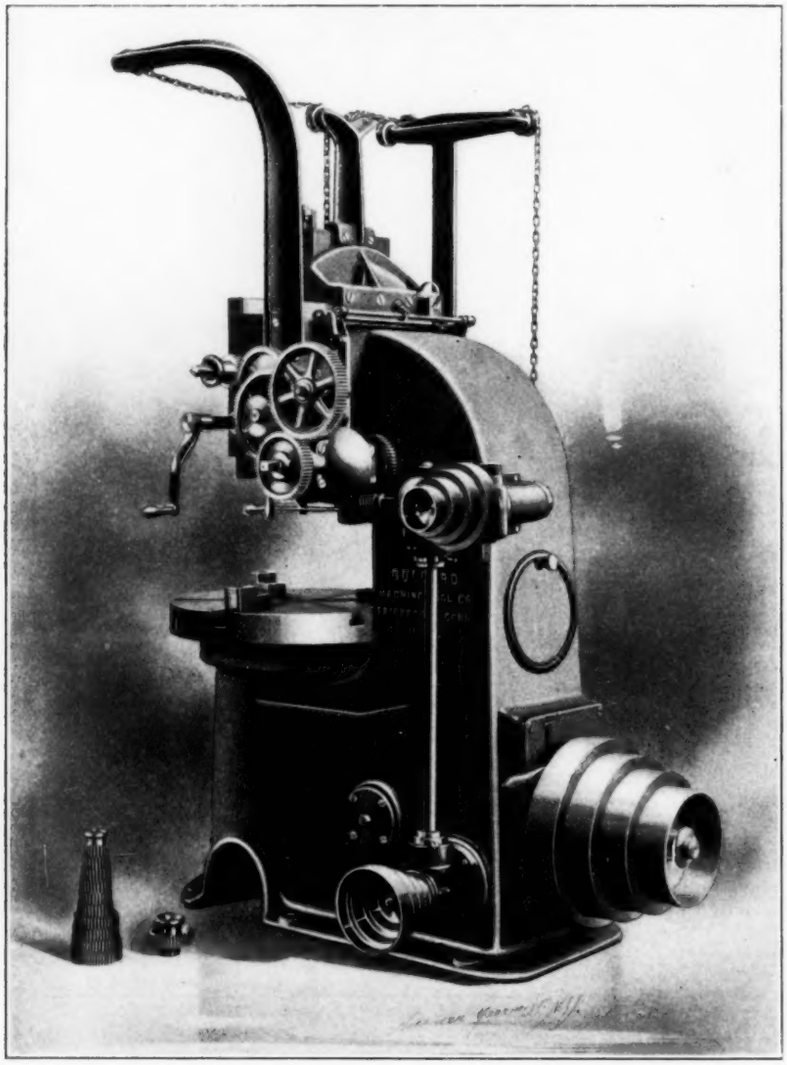


FIG. 12. THE BULLARD MACHINE TOOL COMPANY'S TURRET MILL.

The only new machine which appears in this exhibit is a vertical spindle milling machine, known as the No. 2 and shown in Figs. 13 and 14.

This machine has been developed with all the attention to details, conveniences and refinements of design and construction which are characteristic of this house and the result is undoubtedly a machine of this very useful type which the mechanical public will be glad to welcome. The machine is another illustration of the present tendency to mount all feed gears in permanent position and to provide means for throwing different combinations into gear by the manipulation of levers. The arrangement for doing this is shown inside the column in Fig. 14. The vertical shaft at the rear of the machine is driven by a belt from the spindle pulley, and through a train of gears this shaft drives a cone of gears which are plainly seen at the extreme bottom of the cupboard opening. An upper cone located behind the index plate is driven from the lower cone by an intermediate gear which is held in a yoke connected with the hand latch lever at the bottom of the index plate. Unlatching and shifting this lever to various points on the plate gives six changes of feed, which number is doubled by the small lever at the top of the plate. Plain figures on the index plate show the exact feeds for each position of the latch lever. The feed is carried to the table through the universal jointed rod seen in Fig. 13, at the table end of which is an additional lever which reverses all the feeds. Both longitudinal and transverse feeds are automatic with tripping stops in all directions. An auxiliary splined shaft is shown in Fig. 13 below the longitudinal screw to which it is geared, the object of the shaft being to avoid the necessity of splining the screw.

In addition to the elevation of the knee and table the spindle has a vertical adjustment of 4 inches by the hand wheel at the right of the lower spindle bearing as shown in Fig. 13. Fine feed and quick return are provided through this wheel, the change being made by a movement of the knob at the center of the wheel. This feed is often useful for drilling holes in work already in position for milling. At the end of the oil can spout in Fig. 14 a small hand crank is shown which is for the purpose of adjusting a micrometer depth gage for this vertical spindle movement. This gage is a stop and not an indicating gage.

The spindle driving pulley is not mounted directly upon the spindle, but upon a phosphor bronze bushing mounted upon an upward projection of the upper spindle bearing, there being thus no strain on the spindle due to the pull of the belt. The knee elevating screw will be seen to be telescopic, thus obviating the necessity of cutting a hole in the floor. F. A. H.

Abstracts of Papers Presented at the Engineering Congress at Glasgow.

At the above named congress several papers were read that are of interest to machine constructors, and we publish below abstracts from some of them.

"Power Required to Drive a Marine Engine Works."

By JAMES CRIGHTON and W. G. RIDDELL, of Glasgow.

It is not the intention of the writers to attempt to describe a model engine works or driving plant, but rather to enumerate, and show the result of, a few improvements which have been adopted by the firm with which they are connected.

About three years ago it was decided to rearrange the works in a thorough manner, and to fit up a new power installation. The works had gradually grown during upwards of thirty years, and most of the buildings were in excellent condition and in no need of reconstruction. The problem to be solved then was, how to lay down an economical driving plant which would conform to the existing conditions and which would not lead to an unnecessary sacrifice.

At that time the motive power of the works consisted of one marine type boiler working at 80 pounds pressure and supplying steam to three vertical compound engines for driving the machinery, and one

vertical compound engine for lighting purposes.

The points in favor of so many units were: (1) The saving in steam when running one or two machines at night, which might be driven by one of the small engines; and (2) the fact that, in the event of a breakdown of one engine, the other part of the works were not affected.

It was, however, decided to put in one engine capable of driving and lighting the entire works, and to meet the difficulty of late work by driving those machines which experience showed were most likely to be needed at night, with motors which could be connected with current from the Glasgow Corporation. The engine was made to a simple design, and of such strength as to make the fear of a break-down very remote. It is capable, as at present constructed, of developing 260 indicated horse-power, but this may be increased to 600 indicated horse-power.

A cylindrical marine boiler, designed to work under either forced or natural draft, was selected as the most suitable type, and has proved itself both economical and reliable. It has a working pressure of 200 pounds per square inch and evaporates about 9 pounds of water per pound of coal.

The position of the power station was fixed, to a certain extent, by circumstances. The works are situated in a busy part of the city of Glasgow, where ground is costly and economy of floor space essential. There is no direct communication with any railway, so that all material has to be carted to and from the works. Close proximity to the street was therefore an important factor in settling the position of the boiler. The position chosen was between the engine and boiler departments, and as the difference in the floor level of these departments is about 6 feet, the boiler was placed on the lower level and the coal tipped over into a bunker in front of it. The ashes were returned by a hydraulic hoist to a receiver on the higher level, under which a cart might be filled automatically.

The engine was placed as near the boiler as possible, with the crank shaft parallel to two of the main lines of shop shafting. Two dynamos were laid down for lighting and driving purposes, and these and the two lines of shafting were connected to the main engine shaft with belts, and all so arranged as to be easily disconnected. Motors were laid down to drive all outlying shafting.

Before instituting a comparison between the old and new systems of driving the works, it may be well to enumerate briefly various units which made up the old installation. These were:

1. A marine type boiler, working at a pressure of 80 pounds per square inch. The feed water for the boiler was heated to 205 degrees Fahr., as in the new boiler.

2. Three compound non-condensing engines, indicating collectively, say, 151 indicated horse-power for driving purposes.

3. One compound non-condensing engine, for lighting purposes, of, say, 65 indicated horse-power.

The boiler evaporated about 6.75 pounds of water per pound of coal, and the engines used 43.8 pounds of water per indicated horse-power per hour. This gave an average coal consumption of 6.4 pounds of coal per indicated horse-power per hour.

In calculating the cost of a horse-power for a year, the coal used for raising steam for smithy hammers and blower engines has not been taken into account, but the steam for electric lighting has been charged in each case, as it was almost impossible to obtain accurate figures without doing so. It will be seen that the power for electric lighting is much greater in the new than in the old system, and it may be contended that the greater efficiency of a horse-power in the new system of driving is partly due to the better lit workshops; but this is a refinement into which the scope of this paper does not admit of investigation.

It now remains to be shown by how much the new system is better than the old—or, in other words, at how much smaller cost it produces work. Since the power in an engine works is expended in removing material from rough castings and forgings, a figure may be found by which different systems may be compared; the system by which the greatest weight of material is removed at the smallest cost being the most efficient. In order to make the grounds of comparison similar, the cuttings produced by machines whose scrap is not in proportion to the power expended—such as shearing machines and saws—are not taken into account; but the weight of all turnings, borings, etc., for a fixed period is divided by the cost of a horse-power for the same period, and a money value for the power per ton removed can thus be obtained. From the tables accompanying this paper it will be seen that the cost of removing one ton under the old system of driving was £5.21, and under the new system £2.48, showing a saving by the new system of 52 per cent. Notwithstanding this great saving, it is abundantly clear that the cost may be much further reduced.

It is hoped that this paper may help to provide a basis on which to calculate the relative efficiency of the driving plant in similar works.

"Brinell's Method of Determining Hardness and Other Properties of Iron and Steel."

By Axel Wahlberg, Stockholm.

In the Swedish section of the metallurgical department at the Paris Exhibition were displayed in systematic arrangement some results of experiments and methods of procedure relating to the testing of material, which attracted special attention. The experiments were conducted by Mr. J. A. Brinell, and the expense was borne by the Fagersta Works. They resulted in the development of a new and original method for determining the hardness and, to a certain extent, the tensile and ductile properties of iron and steel. The method alluded to is to be fully worked out on the initiative of the "Jernkontoret," which has granted ample funds for the purpose of carrying out further investigations on an extensive scale in the laboratory for testing materials at the Royal Technical High School at Stockholm. Among the most important questions to be decided by these experiments is that of ascertaining the practical utility of this method for determining the tensile properties of any kind of iron or steel material. For the purpose of comparison the experiments will be made with various qualities of both Swedish and foreign steel, the former being obtained from six or seven different works in Sweden. Mr. Wahlberg's paper gives an account of the results already achieved by Brinell. Among the more comprehensive researches described in a very complete series of results dealing with hardness, determined on steel specimens representing 1,500 different charges of acid open-hearth steel, of a widely varying chemical composition. Many of the experiments were intended especially to illustrate the influence of annealing and hardening, and these probably form the most extensive series of experiments that has ever been attempted for this purpose. In carrying out the tensile tests Brinell made use of thirteen different kinds of steel, of varying composition, each of which had been subjected to no less than thirty-one different modes of treatment. In a second series, which was carried out for the purpose of ascertaining what impact stress the material could withstand, the same thirteen kinds, together with two more, were used, each kind in this case having been treated in ten different ways. Lastly, his researches on the formation of blow-holes in ingots deserve notice. The results in this instance were obtained by testing 871 different charges, without taking any account of the innumerable experiments extending over several years, which Brinell made preparatory to drawing up his programme on the definite lines by which the later results were obtained. The first part of the paper was published in the "Journal of the Iron and Steel Institute" (1901, No. 1, pp. 243 to 298), and the present paper, covering forty pages and illustrated by numerous plates, completes the work. Mr. Wahlberg expresses his regret that Mr. Brinell has been unable to find time to prepare a paper describing his own labors and their results.

"The Internal Strains of Iron and Steel and Their Bearing Upon Fracture."

By Arthur Wingham, F. I. C.

The object of this paper is to assist the elucidation of some of the mysteries attendant upon the physical behavior of metals generally, and of iron and steel in particular, and to throw light upon the

cause of the sudden and unexpected breakages of metal used for machinery and other purposes. Its reasonings are based upon the following facts and hypotheses: That there are two kinds of equilibrium to which a metal attains, viz.: chemical and physical; that the natural tendency of a complex metal is to assume its most simple forms of combination preferentially capable of existing at a given temperature; that its rapidity of cooling, even under the slowest conditions, is too great to allow this to reach finality; that the equilibrium is further repeatedly interfered with by changes of atmospheric and other conditions; that the adjustment to physical equilibrium tends to assist the adjustment to chemical equilibrium; that adjustment which is assisted by slightly raised temperatures, also, as a consequence, takes place in the cold; and that the eutectic is the medium through which the chemical or molecular change takes place, working, of course, in conjunction with the vibration of the molecules. The subject is of both scientific interest and of practical importance. It is of great practical importance in the case of so-called permanent structures, especially where those structures are heavy and subjected to vibration or to shock. In such cases the greatest change or depreciation will take place at the points of jarring contact. Consequently, a strong and tough structural steel, well within the mechanical limits of the specification to-day, may, in the course of a few years, develop some of the properties more generally associated with cast iron. The latest instance of this is the recent mishap to the Brooklyn Bridge. The trouble appears to have been caused by the fracture of the vertical suspension rods holding the traffic way to the cables. The rods, no doubt, had a plentiful margin of original strength to cover any excessive or heavy usage, and it is hardly likely that the fractures were caused by extra traffic alone. It is more probable that the repeated vibration and the release of internal pressure by the persistent tensile strain have accelerated an excessive tendency of the metal to crystallize, and so reduced its tensile strength. Other suspension rods in the same structure are probably approaching the same end. Obviously the internal stability of modern structural steel is worthy of serious consideration, when the selection of the best metal in view of longevity might prevent the comparatively early breakdown of such an important structure.

"The Correct Treatment of Steel."

By C. H. Ridsdale, F. I. C.

This paper, which is one of considerable length, is divided into six sections. The following is a synopsis of the contents:

SECTION I.

Preliminary Remarks.—Much has been learned of late as to how certain conditions in steel are brought about, but the knowledge is not being widely used, probably because it is not clearly connected with practice.

Objects of the Paper.—The author tries to describe, in simple, practical terms what is known. He also formulates certain views and asks for information and discussion as to the control exercised by the maker and the user, their responsibility, tests and processes.

SECTION II.

(a) Composition and Initial Treatment versus Subsequent Treatment. Considered generally as to what is possible. The importance of composition apart from treatment has been overrated. Later treatment often outweighs composition and initial treatment, and the maker can do nothing to provide against this. Twist tests quoted show that rolling hardness outweighs 0.15 per cent. carbon and 0.40 per cent. manganese, while the purest and best steel fails when treatment is unsuitable and irregular, or impure steel stands if the treatment is right. German and American steel runs up to 0.10 per cent. and 0.14 per cent. phosphorus, and sometimes the sulphur is high. Steel users should take as great pains to control treatment as the makers do to control composition.

(b) As to What is Likely in the Ordinary Working Up.—Much steel is worked up by separate users, who do not care to trouble about properties of steel, but simply want to shape it with the least possible cost. This—the use of wrong quality for untried purposes, or by works using chiefly iron—indiscriminate treatment and other causes all tend to develop faults, often only in a small proportion, but discrediting the whole; yet the user seldom thinks of irregularity in his treatment as the cause, but throws the onus on the maker.

SECTION III.

Can the maker do more than at present, and, on the other hand, is it worth the user's while to try what he can do? The maker can supply the most suitable composition when informed what processes the steel must undergo, but any slight further degree of purity attainable, while adding to the cost of production, would not improve the quality nearly so much as the means ready to hand—viz.: for the user to study the character of each steel and treat it discriminately. The best treatment may be quite easy.

SECTION IV.

The condition of steel at different temperatures. The cooling of steel. Steel molten to critical point. Critical point. Below red heat. Blue heat—the state of minimum plasticity. Below blue heat. The reheating of steel. Changes in the grain and "cement."

SECTION V.

Samples of Processes and Treatment Steel Must Undergo.—Treatment by the maker. Rolling ingots. Finishing temperature of material to be reheated before further treatment immaterial. Rails. Medium sections tend to finish right, heavy sections too hot, light sections too cold; these can be controlled somewhat by the rate of cooling. Girders, etc.—Finishing temperatures dictated by tests required. Plates—Much the same. Bars for cold shearing—These should be finished fairly hot, and not chilled in any way.

Treatment by the User.—Rolling after reheating. Reheat as rapidly as practicable for the mass, but all through avoid "soaking" if there is any delay. Avoid burning and over annealing. The best temperatures can only be ascertained by experiment.

The Forge.—Forgings should be worked out while hot enough for work to penetrate the mass. Strains through unequal or partial heating can be removed by reheating without work. Drop forgings, which are often finished too hot, should be reheated to break up the grain.

The Blacksmith's Shop—Forgings and Weldings.—Avoid putting a nice finish at low temperatures. Parts heated to welding without work should be reheated. The use of flux is explained; this latter is most desirable. Tubes—These are difficult to avoid burning or overheating when making thin tubes.

Gas Cylinders and Other Welded Goods.—If only the part heated to welding receive work, these should be reheated.

Plates—Strains Set Up While Flanging.—To avoid these they should be finished fairly hot or annealed.

Sheets—Blackplates and Tinplates.—Annealing may be carried to excess. Streaks, roughness indentations—These are due to foreign substances rolled in. Certain kinds are never due to the steel maker.

Strips for stamping and cold rolling should be finished fairly hot, or, better, annealed.

Strips for welding should be rolled at low temperatures.

Hoops.—These have a tendency to overheat when getting down to thin sections.

Wire Rods and Plain Wire.—Avoid hardness by cooling slowly in masses, and avoid chilling locally by cold objects; the tendency is to draw through extra passes without annealing.

Galvanized Wire.—Brittleness is sometimes induced, especially in the larger sizes.

Pickling Hardness.—This is due to hydrogen, and may be removed by heating. Pickling blisters are distinctive from other kinds, which are essentially the fault of the steel makers and not that of the steel.

Galvanizing is generally recognized as tending to make articles brittle.

Cold Drawing or Rolling.—This has a very marked hardening effect, sometimes producing great brittleness. Material for this should be as soft as possible, preferably annealed.

SECTION VI.

The required standard tests. A table

of faults and their manifestations; by whom originated; their probable cause; and tests for identifying them.

Electrically Controlled Hydraulic Elevators—II.

BY WM. BAXTER, JR.

In a previous article the general arrangement for controlling hydraulic elevators electro-magnetically was described. In the design therein presented, the operating magnets are of sufficient size to move the pilot valve directly. This construction cannot be employed except where the actuating current is derived from a dynamo. In many cases such currents are not available and a device must be provided that can be operated with the current obtained from a primary battery of moderate capacity, or from a storage battery. If the current is obtained from the latter source the magnets can be of somewhat greater capacity than when energized by the current from primary batteries, but the difference cannot be very great because although storage cells are far more economical than primary batteries they are decidedly heavy, and in order that their removal to and from the place where they are charged may not be too much of an inconvenience their weight must be kept down to reasonable limits. The design used by the Otis Elevator Company when the actuating current is derived from a battery is shown in Figs. 1 and 2. This design is also used when the operating current is alternating.

Fig. 1 is a vertical elevation in section of the entire valve gear showing the operating electro-magnets at *M M*. Fig. 2 is a plan of Fig. 1 with the lever *F* removed. As in the valve gears described in previous articles, the pilot valve *m* controls the flow of water to and from the upper side of the cylinder in which the differential piston *H* moves. In order that the effort that the magnets *M M* must put forth may be reduced, an auxiliary cylinder *B* is provided and the magnets are used to actuate valves at *A* which control the flow of water to and from this cylinder. As can be readily seen, these valves can be made much smaller than the pilot valve *m* and therefore will move with a correspondingly smaller resistance.

The piston *C* of the auxiliary cylinder is held normally in the central position, as shown in Fig. 1. Through an inlet *b* water enters or escapes from the lower end, and through another opening at the top, which is not shown in this drawing, the water passes in or out of the upper end of the cylinder. There are two valves at *A*, one behind the other, as seen in Fig. 2 and these are connected with iron armatures that are depressed by the attraction of the magnets.

When the magnets are in the normal position, both the valves at *A* cover the ports so that no water can pass by them except that which leaks through, and this

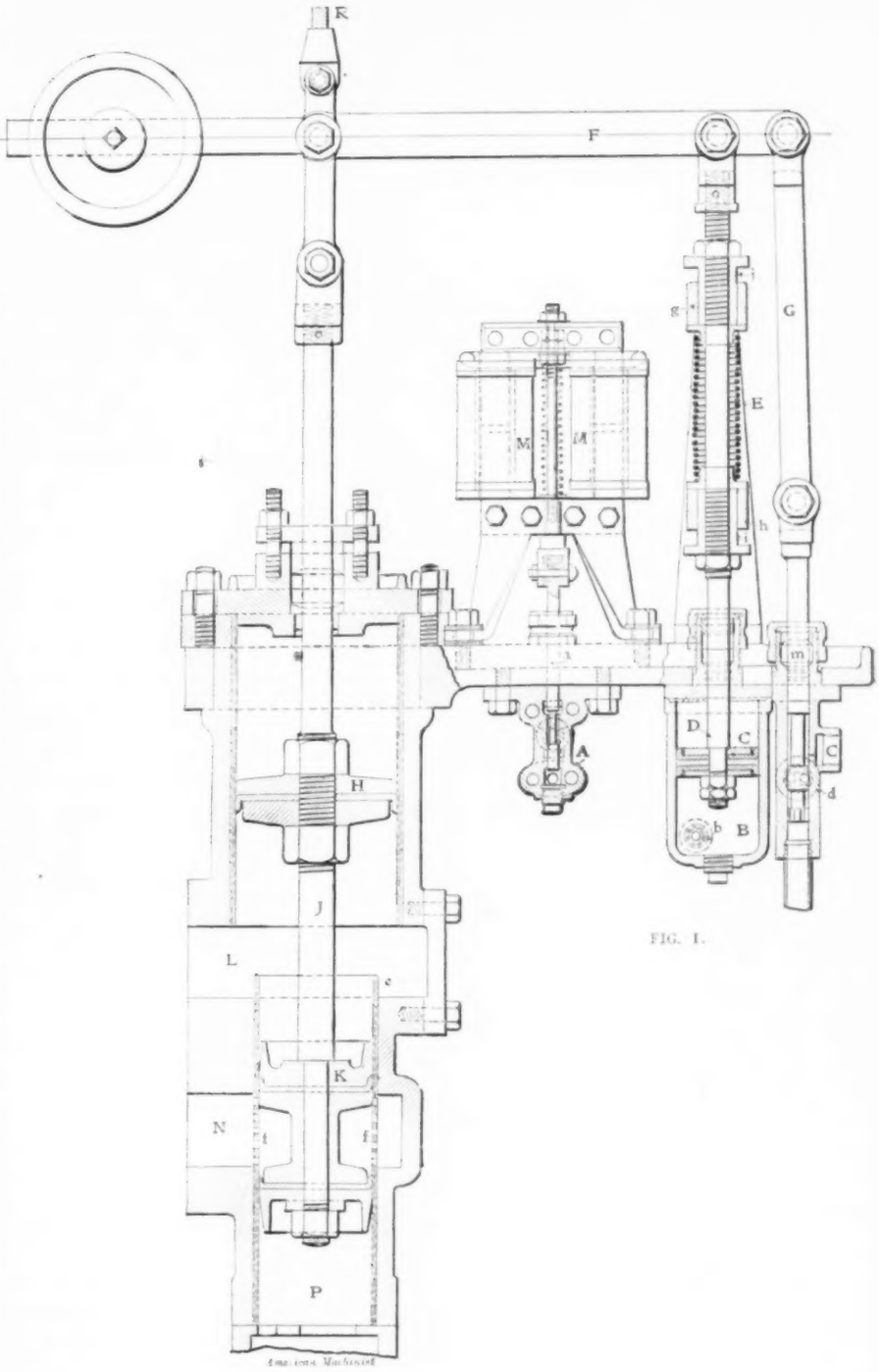


FIG. 1.

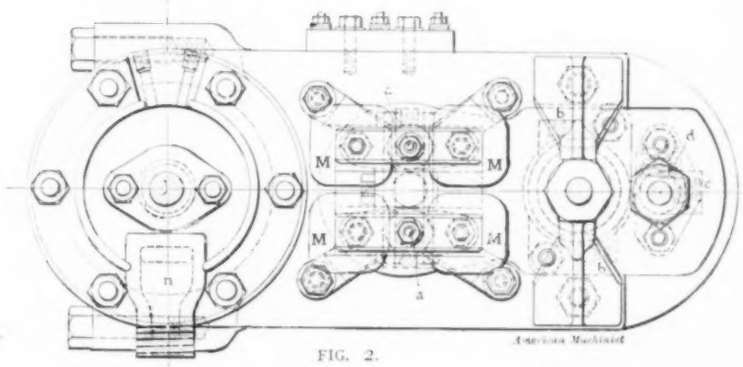


FIG. 2.

PLAN AND SECTIONAL ELEVATION OF VALVE GEAR.

leakage, as will be presently explained, is an advantageous feature. When the operating switch is moved, one or the other of the *A* valves is moved into a position to connect its end of the auxiliary cylinder with the pressure pipe, while the other valve which remains stationary connects the opposite end of the auxiliary cylinder with the discharge pipe. When the *A* valves are so moved, the piston *C* will move to one end or the other of the auxiliary cylinder *B*, depending upon the end that is connected with the pressure pipe. This movement of piston *C* raises or depresses lever *F* and thus the pilot valve.

In this arrangement it will be seen that the movement of the pilot valve depends upon the movement of the piston *C*, of the auxiliary cylinder, hence it is only necessary to make latter of sufficient diameter to obtain any force that may be required to actuate the pilot valve, no matter how much resistance the latter may interpose. On the other hand, the effort required to move the valves *A* can be reduced to a practically insignificant amount, by simply reducing the size of these valves. The only objection to greatly reducing the size of the *A* valves is that the velocity with which piston *C* moves varies with their size, and if they are very small the velocity of *C* may be so slow as to cause the elevator to start up with a lower rate of acceleration than is desired. Practically, however, the *A* valves would have to be smaller than it is necessary to make them to reduce the motion of the pilot valves to an objectionable degree.

The leak through the *A* valves, which will necessarily exist, as they are fitted to move freely, keeps both ends of the auxiliary cylinder full of water at all times so that there is no lost motion, so to speak, but the instant the *A* valves are moved to the operative position the piston *C* begins to move. On this account the size of these valves relative to the size of *C* can be considerably reduced without imparting too slow a motion to the pilot valve *m*, for there is no lapse of time practically between the opening of the *A* valves and the beginning of the movement of *m*. Another advantage derived from maintaining the cylinder *B* continually filled with water is that the jerky movement of the pilot valve *m* is prevented and thus smooth motion of the elevator car is assured.

The spring *E* on the upper end of the piston rod *D* serves to hold the piston *C* in the central position, and also to bring it to this position whenever the valves *A* are brought to the normal position. The bearings *g* and *h* are portions of a guide frame, one leg of which is seen in the drawing directly behind *E*. If the piston *C* moves upward the sleeve *i* compresses *E* against *g*, and if the movement of *C* is in the opposite direction sleeve *j* compresses *E* against *h*. By means of the nuts shown the distance between the bearings *g* and *h* and the flanges of *i* and *j* can be adjusted so as to give the pilot valve whatever length of stroke may be required. The rope *R* attached to the upper end of the main valve rod passes over a sheave and carries on its end a weight that balances the valves and other moving parts. The weight on the end of the lever *F* is for the purpose of effecting a fine adjustment of the balance.

The construction of the *A* valves can be well understood from Figs. 3 and 4. Fig. 3 at the top shows vertical sections at right angles to each other, and at the bottom, on the right-hand side, a plan of the view directly above it, and on the left-hand side a plan in section on the line *A B*.

Fig. 4 shows vertical and horizontal sections of the casting to which the *A* valve chambers are secured, it also shows the valve chambers and this casting in their proper position. The pressure pipe is tapped into the inlet on the line *A B*, as will be seen in the horizontal section, a core runs from this inlet around the central opening and connects on each side with the valve chambers. The opening at the lower end of the separator casting is connected with the discharge pipe, and, as will be noticed in the connected section, upper left-hand corner, there are top and bottom ports in the valve chambers that connect with the discharge. In Fig. 1 the valve *A* is shown covering the central port, which connects with the pressure pipe, and the upper and lower ports are uncovered. This is the normal or stop position of the valves. The outlet on the side of the valve chamber is connected with one end of the auxiliary cylinder, and when the magnet depresses one of the valves the communication between the pressure pipe and the end of the auxiliary cylinder is established. As the other *A* valve remains in the normal position the connection between the other end of the auxiliary cylinder and the discharge pipe is not disturbed.

By the aid of Fig. 5 which shows the pipe connections the flow of water through the valves and cylinder can be fully understood. The upper part of this figure is an elevation taken from the same side and corresponding with the section Fig. 1, and the lower portion is a plan identical with Fig. 2. Through the strainers *G G*

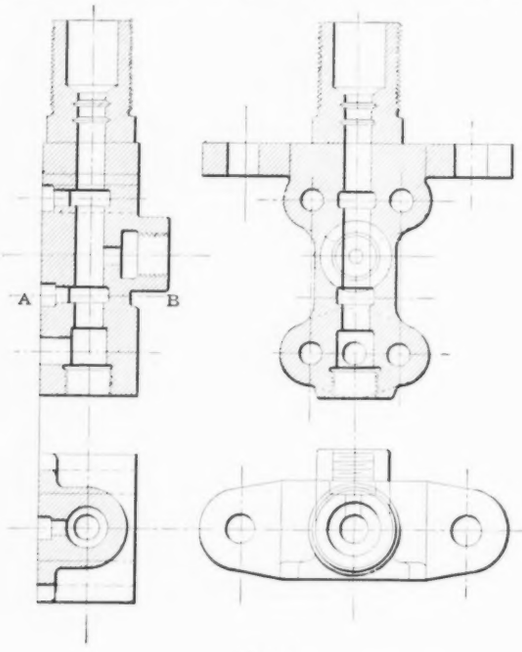


FIG. 3.

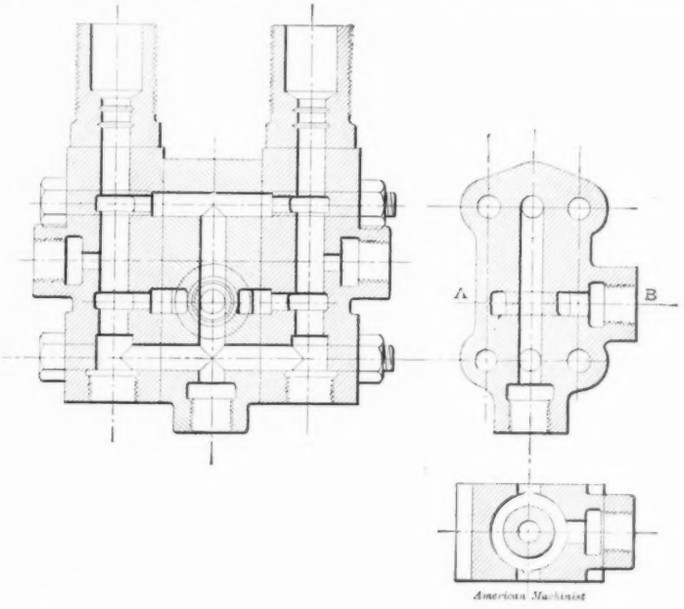


FIG. 4.

CONSTRUCTION OF VALVES FOR AUXILIARY CYLINDER.

and pipes *F* the water from the pressure pipe is conveyed to the pilot valve. The branch pipe *D* conveys the water to the inlet of the separator casting shown in Fig. 4. Pipe *C* connects one of the valve chambers with the upper inlet in the auxiliary cylinder, and pipe *B* connects the other valve chamber with the lower end of the cylinder. It will be seen from an examination of the several drawings that when the valves are in the stop position, water can leak through them either into the ends of the auxiliary cylinder or directly into the discharge pipe. The latter leak is a complete loss, but as the valves are very small the amount of water that can escape through them is practically insignificant, and is far overbalanced by the advantage of having both ends of the auxiliary cylinder always full of water.

Inspection of Pattern Work.

BY JOHN M. RICHARDSON.

In some shops this subject is thoroughly attended to, in some others it is only half recognized, and in still others no attention whatever is paid to it. Is it necessary?

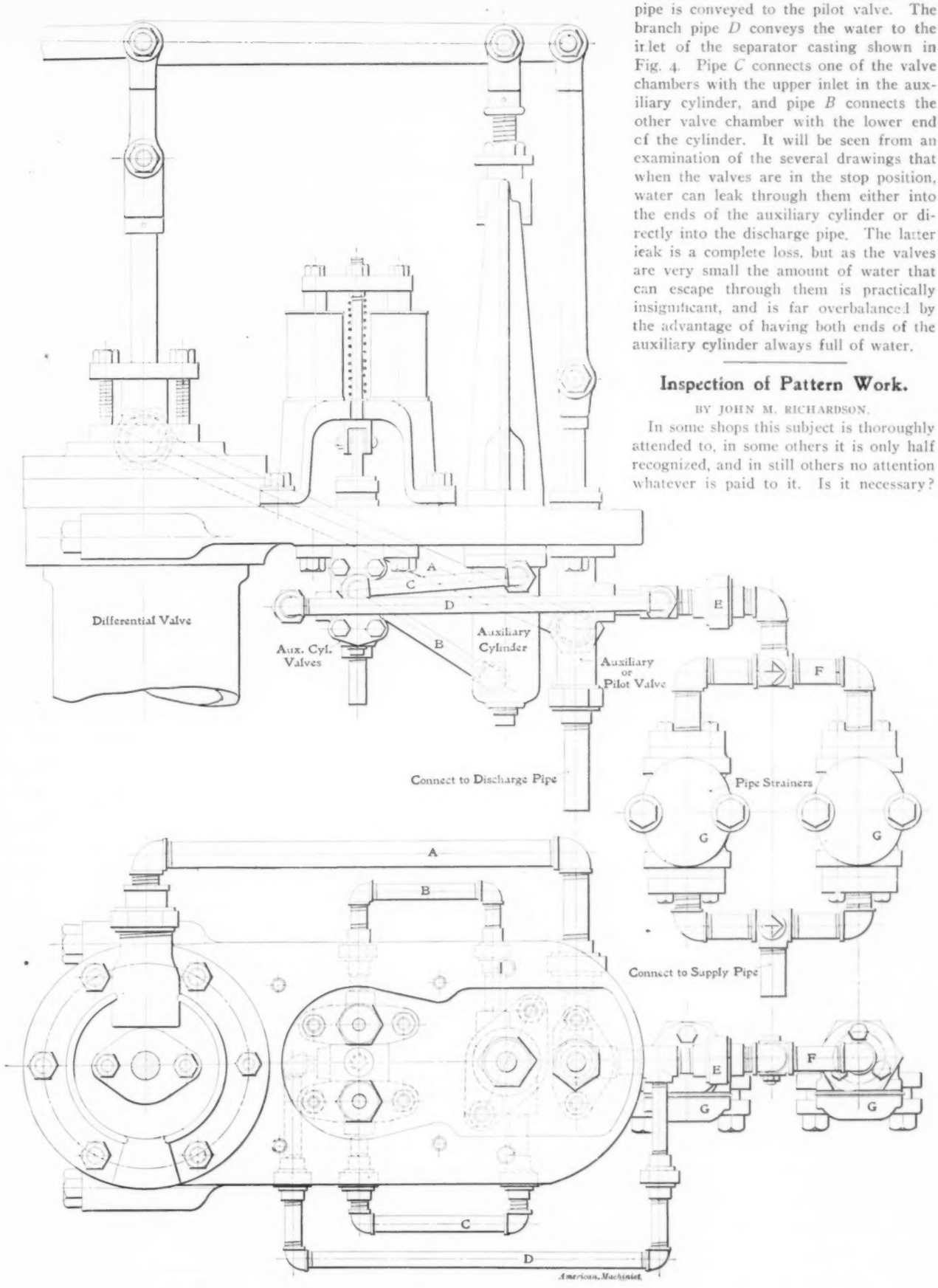


FIG. 5. PIPE CONNECTIONS.

Does it pay? Is it of any particular consequence? I should say yes; for, where the time expended in inspection is represented by cents, the saving in the foundry is reckoned in dollars.

Occasionally we find a concern large enough to afford the luxury of a special pattern inspector, but in the majority of instances the foreman fills the position in addition to his other duties; and in a shop of not over six or eight men he can do it quite comfortably. The idea of an inspector is not to make a workman at the bench any the less careful, but to serve as a check or additional safeguard. No matter how careful and painstaking the man may be, if he has made an error and measured the job over before handing it in, as he always should do, the chances are that if he should measure it over a dozen times he would make the same error every time; but when a second man goes over it, he will be unlikely to make the same mistake and usually will detect the trouble at once.

It takes good sense, sound judgment and a thorough knowledge of patternmaking, molding and drawing to be able to inspect patterns and know what to let pass and what not to. A pattern should be measured with a closeness corresponding to the purpose it is intended to serve. On rough jobs 1-16, or ⅛, or even more, will make no difference, while some parts of very particular work require the dimensions to be within 1-64 inch, or even less, of what the drawing calls for.

After the foreman has inspected a pattern and verified all the dimensions by the drawing, and finds no mistakes or anything to be changed, then the responsibility of the man at the bench should end, even if later it should be found to be wrong. The patternmaker is expected to do his best to get things right; but the foreman is paid extra money for greater responsibility, and if he cannot discover the error if there is one, he should shoulder the blame.

To measure patterns accurately, a large iron plate, at least 2x4 feet, should be provided, mounted on a bench, and the top surface of the plate should be planed and stand level, and at least two of the edges should be finished square. The most useful tool to have within reach of this bench, in addition to calipers and shrink rules, is a good-sized surface gage, having a scriber of long range, with the point on one of the ends bent for reaching to the centers of high bosses, etc. Furthermore, have a good-sized block with a groove or notch sawed in it to fit the edge of a rule, and hold it in a vertical position while taking dimensions.

It is strange that this tool is not used more by the patternmaking craft, as nothing will completely take its place, for lines can be drawn and points may be located that are entirely inaccessible to the commonly used overhanging gage. Again, this is the tool that the machinist invariably uses in laying out work on the casting, so it is the safest way to try to anticipate what will be done in the machine shop; and when measuring a complicated pattern with a multiplicity of important working points, centers, hubs, bosses, etc., begin at the place the machinist will be most likely to, and then verify all other particular measures from this starting point, whether it be a center or a flat face.

It is rather exasperating sometimes to a patternmaker to see how little thought some machinists use in selecting the starting point in laying out a job. For instance, suppose the pattern is quite large and has a series of spots of different hights with center distances to be bored exact and the base of casting to be finished also. Let us further suppose that the casting does not shrink exactly according to the rule the patternmaker used, which is very often the case. Now, what will some machinists do but take the lowest boss, plug the cored hole, find the exact center, plane the base to the figure the drawing calls for, and work upward from the center of one hub to that of the next one above it, and so on until the last one is reached, and then declare that the pattern was wrong! Each successive step in this style of measuring, of course, makes the center of the last bored hole come more and more away from the center of the boss, owing to the shrinkage not coming as expected. Now, if the man in laying out the work had only taken the middle hub and found his first center from this and worked in both directions for the others, the discrepancy would have been divided and probably none of the holes would have needed to be bored out of center enough to look badly. If it were not for the vagaries of shrinkage in the casting and the additional rapping element, which is an unknown quantity dependent on the individual molder, then the work of a good patternmaker and a good machinist would seldom fail to coincide; but as the foundry cannot be eliminated, the patternmaker and machinist must keep cool and use their heads as well as their hands.

A draftsman would save both the patternmaker and the inspector unnecessary questions and many steps if, on a drawing having a dimension figured out of scale, he would only place some designating mark, as an underscored line or a circle enveloping the figure, as is done in many shops, to announce the fact; for if this is not done the patternmaker will be afraid the figure is wrong, and rather than run chances he will ask the foreman, who usually cannot tell any better himself, and so he will have to make a journey to the drawing room, only in most cases to return finding the figure right. It is not pleasant to be obliged to do this, but at the same time there is a chance of saving the drawing room much trouble when there is an error in the figure, and the simple way suggested would save the question.

Important templets made while building a pattern should be passed in with the job for the final measuring, and in some cases the layout on a board also, if the patternmaker has been obliged to have one, and if the work cannot be easily inspected without.

When it comes to a doubtful point as to whether a certain discrepancy from the drawing is of sufficient account to need alteration, or if the error is considerable but apparently of no vital consequence to the design or the working of the machine, and a changed figure would remedy the difficulty, the decision of the head draftsman or designer should be sought and followed without arguments, remembering that the pattern should have been like the figures, and anything of this nature which is allowed by them to slide, is a favor granted by the drawing room to the pattern shop.

It simplifies the inspector's duties to check each figure on the drawing with a little mark as he takes the measure on the pattern; for, on a sheet having a multitude of figures, it requires an extra memory to be sure of what have been verified and what have not. A pencil having a red or a yellow lead will show clearly on a blueprint, and a glance tells how far the work has progressed.

As so many patterns have projecting flanges, ribs, etc., with a web between to be measured as to thickness, it might be well here to mention a little kink in calipering. Of course, there are registering and double-ended calipers, and those with various stops on them to measure work and then open and return to the same place as before; but this is a way to use ordinary calipers over obstructions in the absence of the other kinds: Simply take a little square block (or round, for that matter) exactly one inch, or two inches long, as the obstruction may seem to require; place one end against the part you wish to caliper, and set the calipers over block and all. Remove them and try them on the scale, simply deducting the one inch or two inches of block, as the case may have been. When the length of the block is not known, caliper as before, but place one end of the block against the point of the caliper leg, and measure from the other end of the block to the point of the other leg.

Nickel Steel.

Nickel steel is generally made in the open-hearth furnace and has the composition of ordinary open-hearth steel of about 0.25 carbon and from 3 to 5 per cent. nickel. Nickel is introduced into the composition of steel in the process of manufacture, either in the shape of metallic nickel or nickel oxide. As these melt at a temperature slightly higher than that of molten steel they must be supplied to the furnace in the process of melting, rather than in the ladle after casting, as is customary either with spiegel or alum-

inum. Nickel oxide usually contains about 77 per cent. of nickel. In working the charge considerable loss is encountered and about 7 to 8 per cent. of nickel disappears in the slag.

Nickel steel has a lower melting point than carbon steel of the same carbon composition; thus at the usual melting temperature of carbon steel the effect of nickel is to make the steel very fluid. In the cooling process nickel tends to reduce segregation and liquation, so that a nickel steel ingot is more homogeneous throughout than an ingot of simple steel, and there is less tendency to blow-holes. By the use of fluid compression in casting these defects are eliminated except in very large ingots, and forgings made from the latter, being now hollow forged in best practice, are absolutely sound and homogeneous.

Nickel steel in process of manufacture is very sensitive to changes of temperature. The forging process or the rolling of this metal must be attended with great care, in order that the temperature of different parts of the same body of metal should not have different temperatures. It is this care in handling during the process of manufacture which adds to the expense of the finished product, more than the price of the nickel in the composition of the steel.

The recalescent point of 0.25 carbon steel is in the neighborhood of 1,600 degrees Fahr., and of 0.50 carbon steel in the neighborhood of 1,375 degrees Fahr., while nickel steel of 0.25 carbon and 5 per cent. nickel is about 1,075 degrees Fahr. From this we obtain a reason for the great sensitiveness of nickel steel to heat treatment. Annealing lowers to a slight extent the tensile strength and elastic limit of nickel steel, while oil tempering raises the above properties to an extent beyond which the annealing has lowered them.

Nickel does not have a hardening effect on steel; and nickel steel forgings, although oil tempered and annealed, are not hard to machine. They are, however, exceedingly tough, and more power is required to machine nickel steel of a certain carbon composition than simple steel of the same carbon composition.

For the ordinary run of commercial forgings nickel steel of from 3 to 3.5 per cent. nickel and .25 carbon is used. This produces a metal of an elastic limit and tensile strength equivalent to a simple steel of about 0.50 carbon. This grade of nickel steel will have from 20 to 30 per cent. greater elongation than simple steel of the same tensile strength, and will have 40 per cent. greater strength than simple steel of the same carbon content, with practically the same elongation and reduction of area.

The modulus of elasticity is slightly lower than that of high carbon steel, which will tend to cause it to be considered of less value than the latter in resisting fatigue of metal. High carbon steel, however, is so much more difficult to manufacture on account of the segregation and liquation that resultant forgings are not as satisfactory as those made of nickel steel. Nickel steel forgings, therefore, of high elastic limit are considered best for service where rapid alternations of tensile and compressive stresses are applied. Nickel steel is about half as corrosive as simple steel of the same carbon contents when submerged in salt water or similar baths.

Five-per-cent. nickel steel with 0.25 carbon, oil-tempered and annealed, is especially serviceable for hydraulic cylinders where very high bursting pressures are applied. This steel has an elastic limit of from 150,000 to 175,000 pounds per square inch.—H. F. J. Porter, in "Engineering and Mining Journal."

Where the Dictionary Comes In.

The following is from General Hale's welcoming address to the American Association for the Advancement of Science at Denver:

"And as Colorado as a whole extends the hand of welcome to the American Association for the Advancement of Science we hope that your affinities will be such as to produce a true and stable compound; that the multiphase currents of your various activities will work in synchronism and produce a steady and irresistible torque that will keep the world turning; that your blood may remain uncontaminated by the bacilli of fever which cause delirium, or tuberculosis which leads to decay; that the resultant of your efforts will be in the direction of true progress, and that the centripetal force which holds you together in a conservative orbit will be in such equilibrium with the centrifugal force by which you throw off new ideas as to keep you from flying off on a tangent. We might wish you to remain always in perihelion or 'next' to the sun of prosperity, except that this would mean a state of rest and consequent stagnation. Instead of this may your velocity be accelerated and the differential co-efficient of your curve be an ever-increasing variable until your path becomes asymptotic to the straight line of perfection, and may the final integral of your orbit be the summation of all that is worth knowing."

Catalogs Wanted in Australia.

John Alderdice & Co., Henna street, Warnambool, Victoria, New South Wales, would like catalogs of labor-saving tools and machines for a general engineering establishment, iron and brass founding and also of wood-working and box-making machinery, the latter to include box-nailing and box-printing machines. They write us that they have a number of American machines of different kinds, and will put in others that seem adapted to their work and likely to prove advantageous.

Letters from Practical Men

Overvaluing Machine Efficiencies.

Editor American Machinist:

I would like to say a few words, based on experience, concerning the necessity of knowing what one's rivals have to sell, before sending out men to do "missionary work."

We all know that, taking it by and large, America excels the other nations in the designing and manufacturing of machines. We must not let ourselves build too much on this fact, nor act on the idea that no one else can do anything in our specialties, or that, even granting the superiority of our work, it may not be too dear to get the market. I will take a case which has just come up. An American works hard on a new idea and succeeds in surpassing his rivals at home, and indeed abroad, in the amount of output of a given material, under given conditions which are easy to define and attain. We will say that his output is three and a half units per hour; never mind what the thing is—it may be a gut-scraping machine for sausages, or a valve planer, or anything that comes to mind; the principle is the same. The price fixed is $4,000 f. o. b. New York—for our friend knows better than to quote "f. o. b. Squedunk," for export. But our friend does not know what the European machines are doing; and that is where he misses it. It is true that, as he knows, the opposition machines in Europe turn out only three-quarters of a unit—be the unit a mile of scraped intestines or what-not—per hour. Therefore he thinks that he has the market all for his nice little self and his heirs, administrators, assigns, etc., and he makes all kinds of conditions for the selling agents to submit to, before a single machine has left America. But the snag is this: that the German machines, vastly inferior although they may be, only cost 1,800 marks apiece. Here we have a duty of $3.5 \div 0.75 = 4.67$, it is true; but then we have a price ratio of $17,000 \div 1,800 = 9.44$; and as in this class of machine no continuous attention is required, it would be vastly cheaper for the customer to stick to the native machines; the power transmission being in all cases very simple and cheap.

Another thing that is lost sight of is, the fact that while of course the item of labor is worth looking after, it is by no means so important as with us in America; and where we save labor and call for a skilled man to run several machines, we must not lose sight of the fact that skilled labor is not always to be had; and that even where it is available, the output of the machine in consideration may be limited by the supply of raw material, by the state of the market for the finished product, or by the fact that the output of the machine in question is only half-finished, and that it is of no avail to load up with this half-finished stuff, when the machine

that follows it cannot take care of the amount delivered.

This is a matter that is too frequently neglected by designers on both sides of the water; and this neglect takes place just in that class of machinery where it is of most harm—namely, in automatic machines, each of which does only one particular thing all day long without change of adjustment. If machine No. 1 of a set of four has a capacity of five, and machine No. 2, of three, while No. 3 can take care of six, and No. 4 is rated at four, and so on, what is the use to a manufacturer who runs only one set, to pay for the extra capacity of machine No. 1? The only way by which he could come out even would be to have twelve of No. 1, twenty of No. 2, ten of No. 3 and fifteen of No 4. And even then the duty would not be favorable when all were not at work, and not then unless they were so placed with regard to each other that delivery from one to the other was rapid, easy and cheap.

Another point which is often disregarded or not even seen is that one cannot reckon the same duty abroad as at home. In the first place, it is not technically reasonable to expect that a workman will do as well on a strange machine as on one which he has tended for years; and, in the second place, there is the actual unwillingness to admit that the new can be as good as the old. Added to this passive opposition there is often also the active antagonism to all that tends to diminish the amount of labor on a given unit; for the average laborer does not see now, any more than he has ever seen, that labor-saving machines create a demand for more workmen, not only in their own province of work but in all that are affiliated with it. ROBERT GRIMSHAW.

Hanover, Germany.

Variations in the Velocity of Steam Engine Flywheels.

Editor American Machinist:

The article on this subject by "H. F." in issue No. 33 calls to mind a speed variation test that I applied to the motive power by which our shop was driven, and while it would not answer to indicate the magnitude of variations, nor perhaps to detect them at all if they were very small, yet it was readily applied in the case under consideration, and told its own story without any rigging up.

An inventor came in who wanted us to build a transmitter for "stock tickers," and asked if our shop engine ran at a steady enough gait to drive it, as a uniform rate of speed was a point he seemed to be very particular about. I demonstrated that our engine was not exactly up to his ideal by starting a lathe at a moderate speed and holding a stiff card against the teeth of the main gear. It gave a musical note of which the pitch would fall at the end of each stroke of the engine's piston. Also, the pitch of the note would fall more at one end of the stroke than at the other, as at one end the weight of the crank and connecting rod helped the engine over the center, but at the other end they had more of a retarding action, the engine being of the horizontal type, with a single cylinder. In this way we were able to distinguish between the in-stroke and the out-stroke, although we were on the fifth floor and the engine was on the first.

WALTER GRIBBEN.

Brooklyn, N. Y.

A Proposition, a Problem and a Paradox.

Editor American Machinist:

Referring to the inquiry in your issue No. 29, page 814, entitled "A Proposition, a Problem and a Paradox," I should like to ask a question and at the same time suggest a possible reply.

Is the knurl fed up to meet the work at an angle of 45 degrees to the latter's axis of rotation and not parallel to it? If so, in working out the number of teeth you expect to cut on the collar face, it is necessary to consider the collar to be of its actual diameter plus twice the radial distance through which the knurl is fed after it begins to cut, because it is at the first moment of contact that the pitch is decided. The pitch of the knurl equals .0292 inch. The radial travel between beginning to cut and reaching the full depth is 0.0206 inch. Double this and add to 1.0625 inches and we have 1.1037 inches. The relation between these last two diameters is just the relation between the number of teeth wanted and the number originally obtained.

If the knurl is fed up parallel with the axis of rotation of the collar the number of teeth should come right.

D. R. M. YATES.

Sowfield Foundry, Newark, Eng.

Editor American Machinist:

In answer to the question of Mr. D. R. M. Yates, the feed of the knurling tool is parallel to the axis of rotation of the work—*i. e.*, the knurl holder is held in the tail spindle while the work rotates in the live spindle. Consequently the knurl maintains the same relative position to the circumference of the collar throughout the cut.

In regard to the solution of Mr. Hazard, at page 976, his method and calculations are correct, but he has overlooked the fact that the knurl was actually made 0.559 inch instead of 0.541 inch diameter, the diameter from which he figures.

Taking 0.559 inch for the diameter gives 114 teeth, as we had estimated.

R. B. COCHRANE.

Drilling Glass.

Editor American Machinist:

I note the request of Mr. Corneil Ridderhof asking for information on drilling glass, and have the pleasure of advising him and any of your other readers interested in the subject that the use of *carborundum*, grade 80 to 100, instead of emery on glass work, will be a revelation to them, but if they wish something to cut remarkably fast, then I would suggest "charging" the end of the drilling tube with diamond dust and keeping it constantly wet with paraffine oil while drilling. This diamond dust is easily obtained by pulverizing diamond "bortz" in a hardened steel mortar. F. Jos. LAMB, E. E.

Editor American Machinist:

I have noticed the inquiry of Corneil Ridderhof in regards to drilling glass. If he will use a mixture of turpentine and gum-camphor (the quantities used do not matter much), I think he will find it will aid him in working his glass the usual ways. This mixture put on a file will make the file cut glass about like soft marble. FRED F. DENNIS.

Worcester, Mass.

For Extended Drilling Tables.

Editor American Machinist:

Taking the figures of the Morse Twist Drill Company as correct for the proper number of revolutions per minute at which to run twist drills in average cast iron, and for the number of revolutions required to drill one inch deep in the same material, we have a nice little table which is so useful that it is a pity the Morse Twist Drill Company cannot extend it sidewise to include wrought iron and brass (of some stated composition) and endwise, to take in the 1-16 inch and ⅛-inch sizes below and those running by quarter-inches from 1¼ up to 2 inches inclusive.

Diam. Inches.	Revolutions per Min.	Time to Drill.		Depth per Min.		Diam. Mill.
		1 Inch.	1 Cent.	Inches.	Cent.	
		Min.	Min.			
¼	565	0.29	0.116	3.5	8.75	6.35
½	267	0.5	0.2	1.9	4.75	12.7
¾	168	0.6	0.24	1.68	4.2	19.05
1	115	0.82	0.33	1.22	3.05	25.4

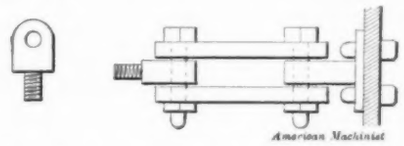
The Morse Company worked out and published the revolutions per minute for drilling wrought iron, cast iron and brass from 1-16 up to 2 inches, advancing by sixteenths; and this information is of a great deal of use where, as in Germany (and also in the British Navy Yard shops, I believe) the prejudice against the twist drill has not entirely given way. It takes very little non-success due to improper handling to cause a man to give up using a tool against which he has a long existing and deep-rooted prejudice. This is more the case with the workmen, who do not wish to show that they cannot handle any tool whatever, than with the shop proprietor, who wishes the best results for his money. G.

The Explosion of the City of Trenton's Boiler.

Editor American Machinist:

On Monday, September 9, I made a careful examination of this boiler, and am satisfied that the explosion was due to the defective construction and method of securing the crown-sheet.

The crown-sheet was held in place by swing stayrods, secured to the top of the elliptic arc shaped shell plate by crow-feet and to the crown sheet by ears having the screwed ends inserted and riveted over, the two being connected by swinging flat staybars, as shown in the sketch. These bars were 4 inches wide and were mainly held in place by 1¼-inch bolts, a few by pan-headed rivets secured by a snap-pin. The staybolts were spaced 10¼ inches across the sheet and 7¼ inches lengthwise of the firebox. The fact that the crown-sheet shows no bagging or sagging between the staybolts proves that the spacing was not excessive. The thickness



METHOD OF SUPPORTING THE CROWN SHEET IN THE "CITY OF TRENTON'S" BOILER.

of the crown-sheet was ½ inch. The side sheet staybolts pulled out of the inside fire sheet, remaining in the outside shell plate. The crown-sheet showed no evidence of being burned or overheated.

I judge that the water was carried some 3 inches above the crown sheet, as indicated by a water-mark of scum on the sides of the boiler. The greatest hight from center of crown-sheet to shell plate was 22 inches. The top of cylindrical shell in which the flues are was about 4 inches below the top of firebox shell.

Now, had the screwed ends of crown-sheet connections extended through the ½-inch sheet and been re-enforced by a nut with a copper washer on the inside of crown-sheet, in place of being screwed into the sheet and riveted over, I believe the explosion would not have occurred. I found a number of the staybolt ends next to the flue-sheet, the threads of which were stripped as though they had been turned off. The construction described above and the excessive test pressure put on the boiler by the inspector, as required by the United States law, were the primary causes of this explosion.

Had the firebox end been of the Belpaire type, the releasing surface and steam chamber would have been increased fully 100 per cent., especially the latter, as in this boiler over the crown-sheet three-fourths of the steam and water space was filled with iron to secure the crown-sheet. This type of boiler has no radial staybolts nor crown-bars. The top of the firebox being parallel to the crown-sheet, the staybolts extend in straight lines and at right angles from the crown-sheet to the top of the boiler. The flat sides are stayed by horizontal tie-rods running from side to side, and the tension on the rods being in straight lines the staying occupies less space.

While I was making this examination an examination was also being made by the inspector of boilers and hulls, with the following results:

Chief Engineer Murphy testified that he examined the gage-cock five minutes before the explosion, and that there were 7 inches of water above the crown-sheet. He also stated that two minutes before the explosion the steam gage at the aft end of the boiler registered 155 pounds per square inch, the allowed pressure being 175 pounds. He also stated that the water in the port boiler was never below one and a half gages, and admitted that the boilers were inclined to "lift the water" and that difficulty was experienced when two gages of water were carried. He was asked if the water was ever out of sight in the gages, and replied: "Never; at the lowest had 4½ inches above the crown-sheet." He was also asked if the safety fuse attached to the exploded boiler had been replaced by a metal one, and his reply was that the builder's original fuse had never been removed.

I heard incidentally from an outside source that when tested it required five minutes to melt the safety plug filling.

The testimony of John A. Bryson, oiler, the only other surviving member of the crew of the steamer who was in the engine- and boiler-room on the day of the explosion, corroborated that of Engineer Murphy. This witness said he looked at the water gage occasionally and that about two minutes before the explosion it showed a little over half a glass. This witness was in the engine-room with Murphy when the explosion occurred.

The material of which the crown-sheet is composed is of the best. This was shown by the fact that when the metal was driven against the inside of the front end of the firebox, it conformed to all the inequalities as though it had been a die where it covered the fire door openings, all recesses being as perfect as if intended to be so stamped.

W. BARNET LE VAN.

The Author of It.

Editor American Machinist:

At page 981 I notice the paragraph beginning "Avoid procrastination as you would the devil," etc. You give credit for this to "Unknown Exchange." In justice to the author I would state that the paragraph in question occurs in the address of Mr. Arthur G. Glasgow, M. E., delivered before the graduating class of Stevens Institute of Technology on the occasion of their commencement exercises, June 17, 1901. The address may be found in full, beginning on page 271 of the July (1901) issue of the Stevens Institute Indicator. F. DER. FURMAN.

The report of the Bureau of Mines of Pennsylvania for 1900 has been issued. In that year the 252,844 workers in and about the mines brought to the surface 130,535,680 tons of anthracite and bituminous coal. This average of 516 tons for each employee was higher than the yearly average in any European country where coal is mined. A lamentable feature of the report is that 676 of the miners met death in their employment, leaving 375 widows and 822 orphans without support. In at least one-half of the fatalities, the deaths could have been averted, the report says, if the workmen had taken proper precautions. As to the future coal supply, the report says: "The combined production of anthracite and bituminous coal for 1900 was the largest ever made in the State, and it indicates that the Keystone State can meet any demand that is likely to be made for the next twenty-five years at least. While the area of anthracite coal is somewhat limited, the mines will be equal to a proportionate increase for years to come; but the production of bituminous coal is limited only by the demand and the capital invested."

Personal.

Max Daunert, manager of the New York office of Schuchardt & Schütte, sailed on the "Augusta Victoria," September 12, for a few months' visit to Europe

N. D. Chard, of the Barker & Chard Machine Tool Company, Cincinnati, is reported to have withdrawn from that concern to take the superintendency of the Lodge & Shipley Machine Tool Company of the same city.

Wm. S. Aldrich, Mem. A. S. M. E., Mem. A. I. E. E., who was recently engaged in consulting engineering practice at Toronto, Canada, has been appointed to the directorship of the Thomas S. Clarkson School of Technology, Potsdam, N. Y.

J. I. Lyle, who for the past five years has been connected with the home office of the Buffalo Forge Company and later has been New York State representative, with headquarters at Syracuse, has been appointed manager of their New York office, at 39-41 Cortlandt street.

Grimshaw's "Shop Kinks," which was published some time ago in German, without the author's knowledge, is now being put into French for a Paris publishing house. Mr. Grimshaw has just finished a second and companion volume—this time in German—and may translate it into French.

The sober second thought of the American peope is beginning to make itself heard. Those who are ignorantly, or with ulterior design clamoring for the virtual

repeal of the Constitutional guarantee of free speech and a free press will speedily hear from a highly important element of the population, which, even for the sake of having the abhorred anarchist outlawed and hunted, is not willing that American liberty should be placed at the mercy of any thick-headed policeman's club. That element consists of all who make use of their brains, and who have sufficient acquaintance with history to know how hardly won has been the sacred right of free speech, the right preservative of all rights. —"Philadelphia North American."

"The Canadian Engineer," of Toronto, has published a chart setting forth in graphic form the metric system of weights and measures. It is suitable for tacking on the wall and ought to be a useful thing in a drafting room or business office. It is sold at ten cents.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant ; see p. 22.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

W. Y. Schmucker, mfrs.' agent, Reading, Pa.

Experimental work, light machinery made. S. Messerer, 24 Boudinot st., Newark, N. J.

Light and fine mach'y to order ; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," $1, post paid. J.L.Lucas,Bridgeport,Ct. Send for index sheet.

Elec. & mech. designing & drawing, also ideas developed. Box 709, Schenectady, N. Y.

Selden Packing for Stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., New York.

See 12 presses & dies for sheet-metals, S. E. cor. Machinery Hall, Buffalo Exposition. Ferracute Mch. Co., Bridgeton, N. J.

F. J. Stokes Machine Co., 13th and Noble sts., Philadelphia, cut light gears, cams and duplicate small machine parts, in quantities.

Wanted—A 100-pound power spring hammer of any good make. Send description and price to Thomas B. Jeffery & Co., Kenosha, Wis.

Machinery built by contract ; modern equipment and organization ; accurate work ; prompt delivery ; low prices ; weights up to 5 tons. The Blanchard Machine Co., Boston.

For Sale at Low Price—Two Warner & Swasey's four-spindle valve milling machines in good condition ; W. & S. 1901 catalog, page 54. The Kelly & Jones Co., Greensburg, Pa.

Gear and Milling cutters, adjustable reamers and special tools ; vertical millers, cutter and surface grinder and shears. Catalog of small tools free. R. M. Clough, Tolland, Conn.

For Sale—Complete set detailed tracings for seven sizes self-contained side crank engines, latest design, 9x12 to 14x18 inclusive ; also patterns ; cost over $1,200 ; will sell cheap. Fisher & Davis, St. Louis, Mo.

Know a certain line of manufacturing thoroughly ; want party to assist me financially to start either independently or in connection with your present business ; correspondence solicited. Box 28, AMER. MACH.

Wanted—Man conversant with general machinery, to invest some money ; established business ; mechanic or office man preferred ; state amount you have to invest and references. C. T. Cummins, 218 E. Division st., Chicago.

Purchaser for small manufacturing plant ; lot, 100x180 feet ; machine shop, 32x68, two story, with line shaft and gasoline power ; foundry, 40x54, new modern equipment ; good location ; for sale cheap. Hart-Parr Co., Madison, Wis.

A prominent typewriter manufacturing company have just opened a department for the manufacture and sale of novelties. Responsible parties having something of this

(Continued on next page.)

Draftsmen Wanted.

We have positions open for capable, experienced Mechanical Draftsmen. Our business is to assist Draftsmen and Engineers (technical men only) to secure positions when unemployed, and to better their positions when employed. Our business was established in 1893.

No registration fee. THE ENGINEERING AGENCY, 1605 Monadnock Block, CHICAGO

Superintendent Wanted.

Liberal salary and other inducements to experienced man to run well-established modern shop in an Eastern State ; must be familiar with light accurate work on interchangeable plan ; an exceptional chance for right man. Address by letter only, J. F. GEORGE, Room 112, Tribune Building, New York.

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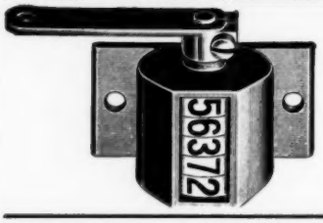

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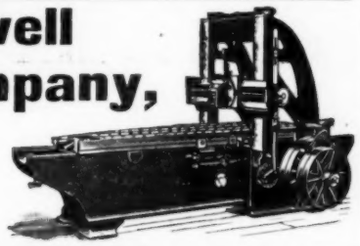

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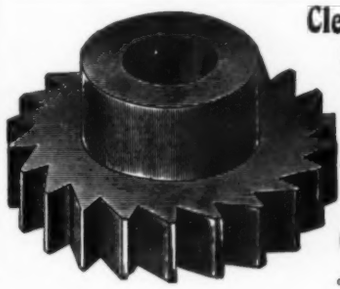

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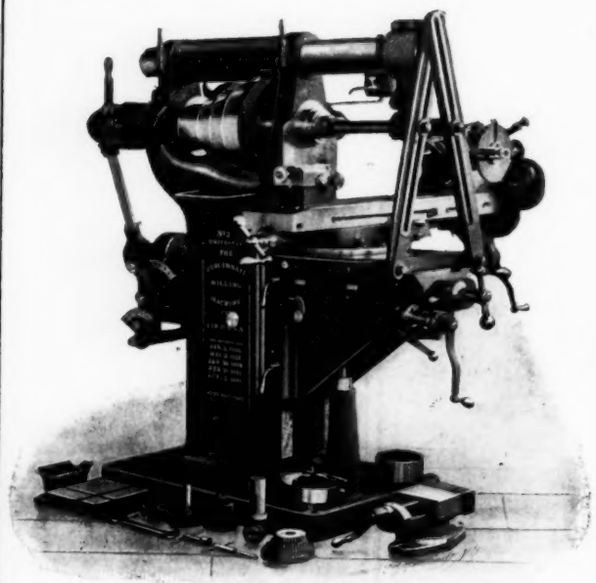

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